# REPORT RESUMES

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## AN INVESTIGATION OF PROGRAMING PRINCIPLES AS APPLIED TO THE PRODUCTION AND UTILIZATION OF FILMSTRIPS AND FILMSTRIP-TYPE MATERIALS IN NATURAL SCIENCE.

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A COMPARISON WAS MADE OF THE EFFECTS UPON LEARNING ACHIEVED FROM (1) EXISTING COMMERCIAL FILMSTRIPS, COMBINING VISUALS WITH PRINTED CAPTIONS AND (2) SIMILAR FILMSTRIPS, COVERING THE SAME CONTENT BUT PRESENTED IN SMALL, PREVIOUSLY TESTED SEGMENTS WITH ACTIVE RESPONSE REQUIRED OF THE STUDENT. ALSO, ATTEMPTS WERE MADE TO (1) STUDY THE EFFECTS OF GROUP AND INDIVIDUAL PACING AND (2) MEASURE EFFECTS OF CONFIRMATION OF RESPONSE TO QUESTIONS ASKED DURING PRESENTATION AND COMPARE THE RESULTS WITH RESULTS FROM PRESENTATION WITH NO CONFIRMATION. IN GROUP PRESENTATIONS, THE CAPTIONS WERE READ BOTH VISUALLY AND ORALLY, BUT IN INDIVIDUAL STUDY THE CHILD HAD NO ORAL PRESENTATION. THE STUDY WAS MADE WITH STUDENTS IN GRADES 5, 7, 11, AND 12. RESULTS INDICATED THAT IN ALL GRADES THE PROGRAMED PRESENTATION PRODUCED BETTER POST-TEST SCORES. HOWEVER, NO CONCLUSIONS COULD BE DRAWN CONCERNING RELATIVE EFFECTIVENESS OF INDIVIDUAL PRESENTATION AND PACING OR OF GROUP PRESENTATION AND PACING. NO SIGNIFICANT DIFFERENCES WERE FOUND THAT WOULD VERIFY EFFECTIVENESS OF CONFIRMATION. (AL)

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U. S. Office of Education, Grant No. 7-48-0720-123

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# CHAPTER I

# INTRODUCTION

In a previous study (VanderMeer & Thorne), conducted under the sponsorship of the U. S. Office of Education, filmstrip lessons were found to be most effective when the content was presented in small units, and when the learning resulting from these units was tested immediately. The method embodied certain elements that relate to programed instruction, i.e., size of learning step and immediate testing. On the other hand, certain features of the method were inconsistent with the basic idea of programed instruction in that it did not permit individual students to proceed at their own rate nor to repeat parts of the lesson. The finding regarding the superiority of the "programed" or "part method" technique of presenting filmstrip lessons was a by-product of a study undertaken to develop principles for improving filmstrips as teaching devices for class-size groups. It seemed logical, therefore, to examine even more variables related to programed instruction and to apply them to the production and utilization of filmstrip-type materials.

## The Problem

The major problem of the study was to explore the relative effects upon learning of (a) extant commercial filmstrip format material, pictorial and graphic with related visual verbal captions, and (b) similar filmstrip material, covering the same content, which had been programed; i.e., broken into small bits of information, previously tested on learners, and requiring active participation during the learning process. In addition, the study sought to explore the relative effects upon learning of (a) immediate confirmation of correct and incorrect responses to questions inserted throughout the material compared with no confirmation, and (b) individual viewing and pacing of the stimulus material compared with group viewing and pacing.

## Review of Related Literature

The study is concerned with the filmstrip, of varying format, as a type of stimulus material, with confirmation of response, and with individual versus group pacing. This portion of the chapter is organized under three major headings: stimulus material, confirmation, and pacing.

Stimulus Material. Many studies have been conducted in an attempt to assess the effectiveness of filmstrips compared with other media. In a recent review of research dating back to 1924, Allen (1960) presented no evidence which would clearly indicate that filmstrips were more or less effective than other types of instructional media. McBeath (1961) compared a 16mm filmograph, a sound filmstrip in which the sound track of the filmograph was duplicated with the addition of an audible tone as a cue to turn to the next frame, a captioned filmstrip with recorded narration, and a silent captioned filmstrip. On immediate and retention tests no single method was found to be significantly superior in presenting facts and concepts although the captioned filmstrip with narration showed slight superiority to the other versions. Experiments have demonstrated that a considerable amount of learning can be derived from filmstrips; however, it cannot be concluded that students learn more or less from them than from any other instructional medium.

Several recent studies have indicated that the instructional effectiveness of teaching materials can be enhanced by diagnostic evaluation which involves testing the stimulus material on representative groups of subjects then revising the content to promote learning. It is a technique used extensively in the preparation of materials for use in teaching machines and programed texts. Gropper and Lumsdaine (1961) pretested two television lessons in science with a sample class and used feedback to revise the lessons. This procedure resulted in a ten to fourteen per cent improvement over the original in the number of correct responses on an objective achievement test. Fleming (1963) using a similar technique in the production of an educational motion picture was able to show a thirteen per cent mean gain over the conventionally produced film.

Since diagnostic evaluation and systematic revision of film and television stimulus materials appear to improve their instructional effectiveness, it was hypothesized that the same would also be true of filmstrip stimulus materials. Thus the first expectation from the data was that there would be a difference in learning between groups of subjects who received instruction by a commercial non-programed filmstrip and those who received instruction by a programed filmstrip.

Confirmation of Response. A great number of film studies have dealt with the variable of student participation. Types of participation have included recitation, overt and covert mental practice, rehearsal, knowledge of results, verbalization, discussion, and note-taking. In a review of twenty-six research studies, Allen (1957) concluded that verbalization of response and the knowledge of results appear to be the most effective participation techniques. He later stated (Allen, 1960) that one of the most effective ways to increase learning from motion pictures is to build-in participation followed by knowledge of the results. The studies failed to demonstrate conclusively, however, what type of confirmation is most effective.

Angell (1949) tested the effectiveness of immediate versus delayed confirmation with 162 college chemistry students. He used a Pressey-type punchboard to give students immediate confirmation of the correctness of their response. The other group of students used IBM score sheets and were given the results of their test at the next meeting of the class. Final examination scores were significantly higher for students receiving immediate knowledge of results. In a study designed to test the interaction of response mode with student aptitude, Burton and Goldbeck (1962) presented three versions of a program to ninth grade students. The programs differed with respect to the type of response: constructed response, multiple choice questions with difficult options, and multiple choice questions with easy options. The results did not support the previous hypothesis that constructed responses are superior to multiple choice responses. No significant differences were found among the three versions tested. Kaess and Zeaman (1960) used a Pressey-type punchboard with college students to test the effect of punching wrong answers on the punchboard. The learning task was the definition of psychological terms. The results indicated that reading the correct answers was as effective as reading the correct answers plus punching.

The above research indicates that student participation and confirmation of response have a positive effect on learning through the film medium and through programed instruction. The results, however, are inconclusive with respect to the most effective type of confirmation. Previous research thus indicates that the opportunity for student participation during his exposure to the stimulus material is a desirable feature. The most effective method of confirming that response has not clearly been established; therefore it was one variable selected to be tested. Thus the second expectation from the data was that there would be a difference in learning between groups of subjects who receive confirmation of the correctness of their response and those who receive no confirmation.

Pacing. The principle of self pacing is one that is accepted conceptually by many programers. However, the experimental literature does not clearly support its value. A number of studies have reported no significant differences attributable to individual or external pacing when the students were taught by various media--from teaching machines to television. Lottes, Palmer and Oakes (1963) found that it was possible to teach groups of learners at the college level with programed materials on television or film. In one experiment they found that it was possible to vary the pace of the class twenty per cent below and ten per cent above the average of class self-pacing without significantly decreasing the amount of learning. Gropper and Lumsdaine (1961) also found evidence that programed television lessons would result in more learning than non-programed lessons. Frye (1963) compared four homogeneous groups of high school freshmen in an effort to determine the effect of individual versus group pacing. Among other findings, he found that a homogeneous and externally-paced group took no longer than a self-paced group to complete the learning task. These findings raise some serious doubt about the necessity and effectiveness of individually-paced learning in all situations. There are even some indications that students learn somewhat more efficiently in a group situation, however this hypothesis has not been tested.

Since the literature does not give a clear indication of the value of self-pacing it was selected as the third major variable. Thus the third expectation from the data was that there would be a difference in learning between groups of subjects who pace themselves through the stimulus material and those who were paced at a group rate.

## Overview of the Study

The report of the study is divided into three sections. Chapter II, Method, presents a discussion of the independent and dependent variables and a detailed explanation of the method used to prepare the stimulus material, conduct the study, and analyze the results. The results of the experiment are presented in Chapter III. In Chapter IV the findings are discussed and recommendations given for further study.

# CHAPTER II

## METHOD

The hypotheses of this study were tested in three experiments. Each experiment was comprised of subjects from one grade level or a two grade combination--fifth, seventh, and eleventh and twelfth grades. A commercial filmstrip Earth's Satellite--The Moon produced by the Society for Visual Education was modified for use in the study.

### Independent Variables

The three independent variables were (a) the stimulus materials (the programed filmstrip identified hereafter as P versus the original filmstrip identified hereafter as O), (b) confirmation (immediate confirmation identified hereafter as C versus no confirmation identified hereafter as NC), and (c) presentation and pacing technique (individual viewing and self pacing identified hereafter as I versus group viewing and pacing identified hereafter as G). The combinations of these variables and intervals of each variable resulted in six experimental treatments for each grade level:

1. P C G--The stimulus material was the programed filmstrip. Each subject received immediate confirmation for each of his responses and viewed the filmstrip in a group.

2. P C I--The stimulus material was the programed filmstrip. Each subject received immediate confirmation of his responses and viewed and paced the filmstrip individually.

3. P NC G--The stimulus material was the programed filmstrip. The subjects received no confirmation of responses and viewed the filmstrip in a group.

4. P NC I--The stimulus material was the programed filmstrip. The subjects received no confirmation of responses and viewed and paced the filmstrip individually.

5. O G--The stimulus material was the original filmstrip. The subjects viewed the filmstrip in a group.

6. O I--The stimulus material was the original filmstrip. The subjects viewed and paced the filmstrip individually.

Subjects from each grade level were randomly assigned to one of the experimental groups.

Stimulus Materials. The content of the first thirty-two frames of the filmstrip Earth's Satellite--The Moon produced by the Society for Visual Education was selected as a basic content area for this study. The content in each frame of the original filmstrip was broken down into very small bits of information. Each small bit of information was then written into a separate frame in the programed filmstrip. Multiple choice questions were inserted after each content frame of the programed filmstrip to cause the subjects to respond actively to each bit of information that had been presented to them. The rough draft of the programed filmstrip was presented to fifth and seventh grade children to provide information to the programers for needed revisions. The revisions were made as indicated by the trial presentation, and the Society for Visual Education then produced the programed filmstrip so that the technical and artistic quality of the original filmstrip and the programed filmstrip were identical. The original filmstrip consisted of thirty-two frames and the programed filmstrip consisted of ninety-two frames. However, both filmstrips contained the same content (Appendix A).

Confirmation. Each subject who viewed the programed filmstrip was provided with a Rapid-Rater (Shaw Laboratories, Inc.) on which he responded to each of the multiple choice questions. The Rapid-Rater (Figure 1) is a device which is small enough to be held in the subject's hand or placed before him on the desk. Both the front and back of the device contains 40 sets of perforations, four to a set. Each perforation of each set of four is identified by the letter A, B, C or D at the top of each column. Each set of four perforations is identified by number: 1 through 40 on the front, and 41 through 80 on the back.

At the top of the Rapid-Rater there are four slots. The two outer slots are used to hold answer sheets. The two inner slots are used to hold scoring keys. Each scoring key is perforated in accordance with a prearranged answer pattern. Questions are answered by using a stylus to perforate the answer sheet. If the answer selected by a subject corresponds to the correct answer perforated on the scoring key, the stylus penetrates the answer sheet and the scoring key, making a larger perforation in the answer sheet. If the answer selected by a subject does not correspond to the correct answer perforated on the scoring key, the stylus penetrates only the answer sheet making a small hole in the answer sheet. The subject receives confirmation by two means: (a) the depth of penetration of the stylus and (b) the size of perforation made in the answer sheet. An instruction sheet with practice questions for

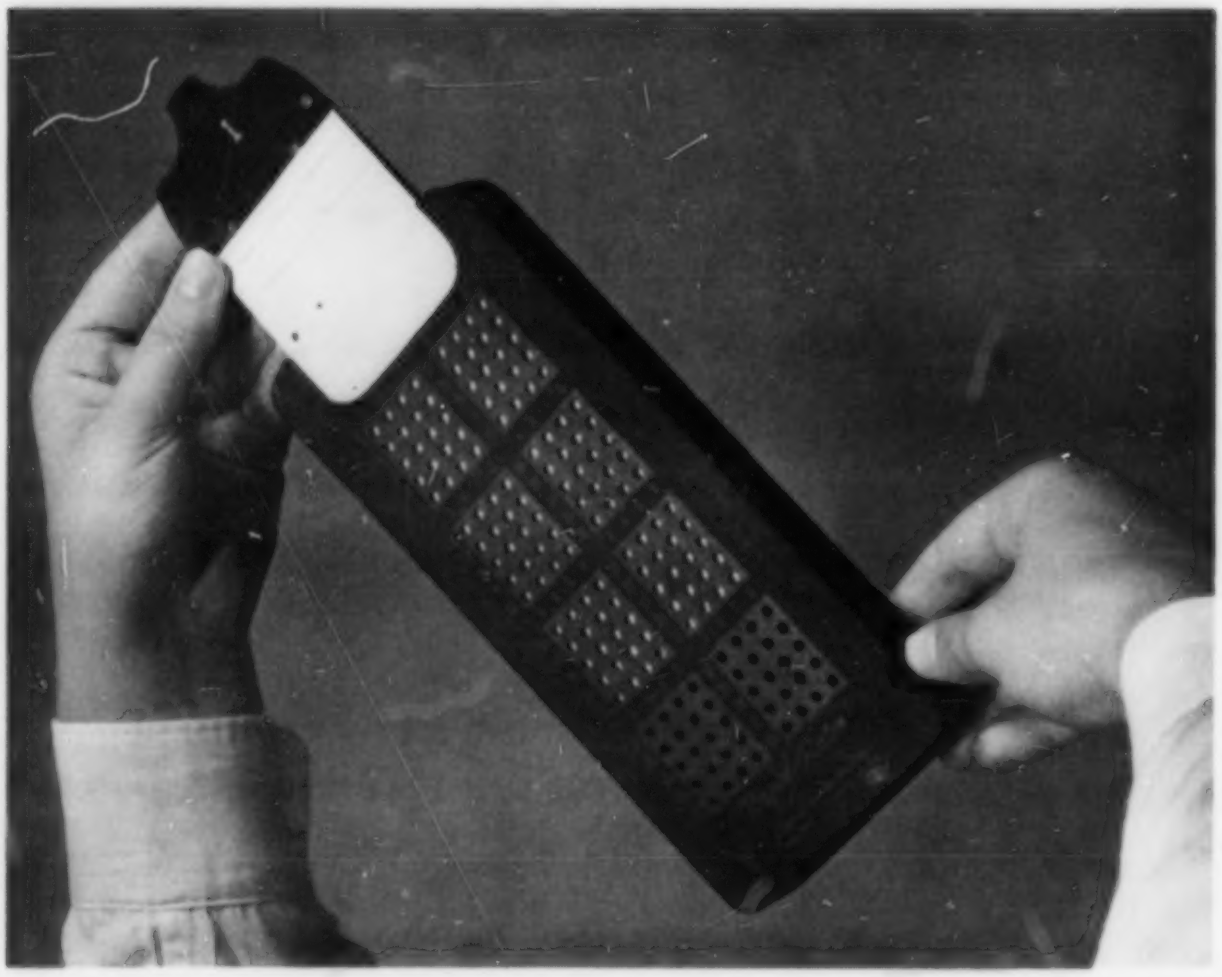

Figure 1. The Rapid-Rater Used for Responding to Questions

the Rapid-Rater was given to each subject (Appendix B).

Those subjects who were to receive confirmation used Rapid-Raters in the manner described above. If their first response was not correct, they were told to reread the question and select another answer. The scoring keys were removed from the Rapid-Raters used by those subjects not receiving confirmation. An instruction sheet with practice questions for the Rapid-Rater was given to each subject (Appendix C). Each of their responses were recorded identically on their answer sheet whether it was a correct or incorrect response. This procedure allowed both experimental groups to respond in an identical manner but controlled the confirmation variable.

Presentation Technique. Two types of presentation and pacing techniques were used in this study: (a) group viewing and pacing and (b) individual viewing and self pacing. The group viewing and pacing was quite similar to the regular classroom use of a filmstrip. The subjects were brought into a properly darkened and ventilated room where a projector and screen had been set up. The proctor for this group read the captions and the questions which appeared in the filmstrip to the group. Each subject in the group read the alternate options for each question to himself and registered his response on his own Rapid-Rater.

Individual viewing and self pacing was provided by using individual filmstrip viewers. In this situation each subject was provided with 1 filmstrip viewer, 1 filmstrip, and 1 Rapid-Rater. These subjects were allowed to use as much time as they needed in viewing the filmstrip and in answering the questions. They were permitted to back up or go ahead as their needs dictated (Figure 2).

## Dependent and Adjusting Variables

Two adjusting variables and one dependent variable were used in this study. The chronological age and pretest score of each subject was used for adjusting variables and each subject's score on a posttest was the dependent variable.

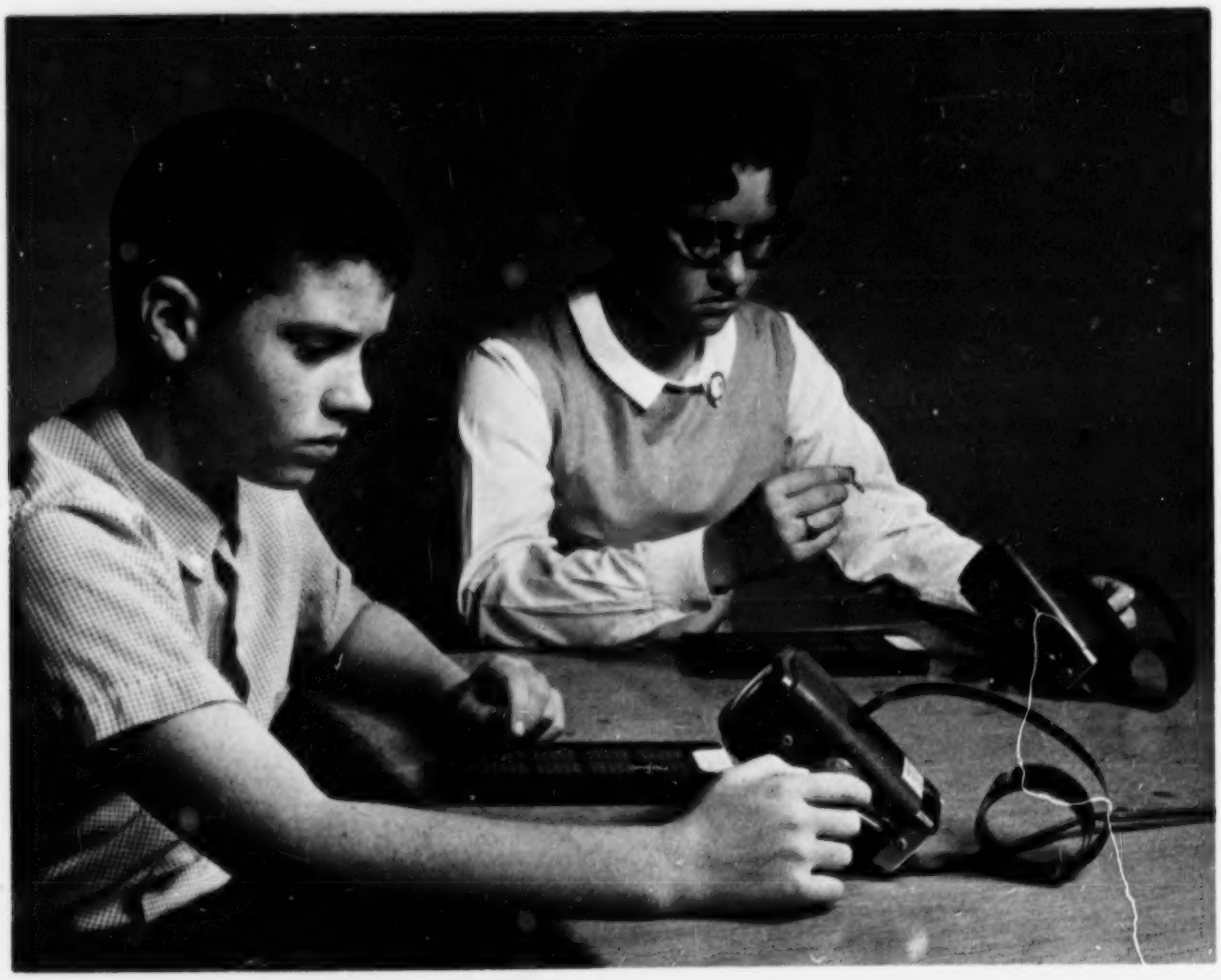

Figure 2. Individual Viewing and Pacing with Rapid-Raters for Responding to Questions

Chronological Age. The classroom teachers for each of the fifth grade classes used in the study supplied the investigators with the birthdate for each subject which was converted to chronological ages in months. The seventh, eleventh, and twelfth grade subjects were asked to write their birthdate on their pretest answer sheet. The investigators then computed the chronological ages in months for each of these subjects. These chronological ages were used as an adjusting variable in an analysis of covariance. The coefficient of correlation between chronological age and posttest scores is reported in Chapter III with the experimental data pertaining to each analysis.

Pretest. A ten-item multiple choice pretest (Appendix D) was developed which was administered immediately before each subject was given his experimental treatment. The ten items in the pretest tested the subjects on the content of the first eight frames of the original filmstrip which corresponded to the first twenty-three frames of the programed filmstrip. The test was designed to test the subjects on only the first portion of the two filmstrips so that this would not have a practice effect on the posttest. The coefficient of correlation between the pretest and posttest scores is reported in Chapter III with the experimental data pertaining to each analysis.

Posttest. A thirty-item multiple choice posttest (Appendix E) was administered to each subject two days after he had received the experimental treatment. The posttest tested the subjects on the content not tested by the pretest--the last twenty-four frames of the original filmstrip and the last sixty-nine frames of the programed filmstrip. The posttest contained verbal type questions and questions using pictorial illustrations which resembled material seen in both versions of the filmstrip.

## Subjects

Early in the 1963-64 school year the chief administrators of the Philipsburg-Osceola Area Schools and the Williamsport Area Schools in Pennsylvania were contacted. The purpose and procedures of the study were outlined at a meeting held with the chief school administrator and the supervising principal from each of the schools involved. The chief school administrators and the supervising principals indicated their willingness to cooperate in the project and agreed to ask the teachers whose classes would be involved not to teach any science units on the universe until after the study had been completed. Specific programs for each school were arranged individually with the supervising principal and classroom teachers.

The fifth grade classes from the Osceola Mills elementary school in Osceola Mills, Pennsylvania, the Lincoln Elementary School in Philipsburg, Pennsylvania and the J. Henry Cochran School in Williamsport, Pennsylvania were the subjects of the study. Seventh grade subjects were obtained from the Philipsburg Junior High School and from the Andrew Curtin Junior High School in Williamsport, Pennsylvania. The eleventh and twelfth grade subjects were all drawn from the Philipsburg-Osceola Area Senior High School in Philipsburg, Pennsylvania. In each case, subjects used in this study were from homogeneous classrooms. An attempt was made to use subjects which were as nearly average and representative of their population groups as possible.

## Procedures

The subjects in each classroom were randomly assigned to one of the six experimental treatments. In each case the classroom teacher supervised the children which the experimenters were not treating at any given time. The investigators of the project conducted all of the experimental treatments in all cases.

## Statistical Analysis

Analysis of covariance was used for testing the hypotheses in the experiments. The chronological ages of the subjects and the pretest scores of the subjects were used as adjusting variables for the posttest scores. When analysis of covariance revealed significant differences attributable to interaction between the two independent variables, Scheffe's Test of Selected Contrasts was applied to determine significant differences between the four cells. The hypotheses were rejected at the .05 level of confidence.

# CHAPTER III

# RESULTS

## Experiment I

Experiment I included ninety-six subjects in the fifth grade. Two scores were obtained for each subject: pretest score and posttest score. The chronological age and pretest score for each subject were used as adjusting variables for the posttest score. Three analyses were performed on the data from each experiment in order to compare all of the variables. Analysis A compared the effects of presentation and pacing techniques with the original filmstrip and with the programed filmstrip with confirmation for responses. In Analysis A, Experiment I, the coefficient of correlation of the adjusting variables and the dependent variable were as follows: chronological age--posttest r = -.005 and pretest--posttest r = .188. The adjusted mean scores for Analysis A, Experiment I, are shown in Table 1. Raw data for experiment I are reported in Appendix F.

TABLE 1. ADJUSTED MEAN SCORES FOR ANALYSIS A, EXPERIMENT I

| | Presentation and pacing technique | | |
|---|---|---|---|
| Stimulus materials | Group | Individual | Average mean |
| Original filmstrip | 7.892 | 8.730 | 8.311 |
| Programed filmstrip with confirmation | 10.231 | 7.772 | 9.001 |
| Average mean | 9.062 | 8.251 | 8.656 |

N = 64, n = 16

An analysis of covariance was performed which yielded the results summarized in Table 2.

TABLE 2. ANALYSIS OF COVARIANCE ON POSTTEST SCORES
FOR ANALYSIS A, EXPERIMENT I

| Source of variation | Degrees of freedom | Adjusted sum of squares | Mean squares | F |
|---|---|---|---|---|
| Presentation and pacing technique | 1 | 10.480 | 10.480 | 1.80 |
| Stimulus materials | 1 | 7.570 | 7.570 | 1.30 |
| Interaction | 1 | 36.387 | 36.387 | 6.25* |
| Within subgroups | 58 | 337.482 | 5.819 | |

* significant at the .05 level of confidence

Null Hypothesis #1. Learning as measured by a posttest does not differ between groups of subjects in the fifth grade given different presentation and pacing techniques (group presentation and pacing or individual presentation and self-pacing). An F-ratio of 1.80 (df 1/58) for presentation and pacing technique is not significant. The data therefore fail to reject Null Hypothesis #1.

Null Hypothesis #2. Learning as measured by a posttest does not differ between groups of subjects in the fifth grade given different stimulus materials (standard filmstrip or programed filmstrip with confirmation for response). An F-ratio of 1.30 (df 1/58) for stimulus materials is not significant. The data therefore fail to reject Null Hypothesis #2.

Null Hypothesis #3. Learning as measured by a posttest does not differ for stimulus materials (original filmstrip or programed filmstrip with confirmation for responses) between presentation and pacing technique groups (group presentation and pacing or individual presentation and self-pacing) in the fifth grade. An F-ratio of 6.25 (df 1/58) for interaction is significant at the .05 level of confidence. The data therefore reject Null Hypothesis #3.

Scheffe's Test of Selected Contrasts was applied to the adjusted interaction mean scores for Analysis A, Experiment I. The results are shown in Table 3. None of these differences (df 1/58) were significant.

TABLE 3. SCHEFFE'S TEST OF SELECTED CONTRASTS BETWEEN ADJUSTED INTERACTION MEAN SCORES FOR ANALYSIS A, EXPERIMENT I

| | O G | O I | P C G |
|---|---|---|---|
| O I | .837 | | |
| P C G | 2.338 | 1.501 | |
| P C I | .121 | .958 | 2.459 |

Analysis B, Experiment I, compared the effects of presentation and pacing techniques with both the original filmstrip and the programed filmstrip with no confirmation for responses. In Analysis B, Experiment I, the coefficient of correlation of the adjusting variables and the dependent variable were as follows: chronological age--posttest r = -.059 and pretest--posttest r = .129. The adjusted mean scores for Analysis B, Experiment I, are shown in Table 4.

TABLE 4. ADJUSTED MEAN SCORES FOR ANALYSIS B, EXPERIMENT I

| Stimulus material | Presentation and pacing technique: Group | Presentation and pacing technique: Individual | Average mean |
|---|---|---|---|
| Original filmstrip | 7.897 | 8.692 | 8.295 |
| Programed filmstrip with no confirmation | 8.644 | 9.579 | 9.111 |
| Average mean | 8.271 | 9.135 | 8.703 |

N = 64, n = 16

An analysis of covariance was performed which yielded the results summarized in Table 5.

TABLE 5. ANALYSIS OF COVARIANCE ON POSTTEST SCORES FOR ANALYSIS B, EXPERIMENT I

| Source of variation | Degrees of freedom | Adjusted sum of squares | Mean squares | F |
|---|---|---|---|---|
| Presentation and pacing technique | 1 | 11.2045 | 11.204 | 1.55 |
| Stimulus materials | 1 | 10.5534 | 10.553 | 1.46 |
| Interaction | 1 | 0.0641 | 0.064 | < 1.00 |
| Within subgroups | 58 | 419.3434 | 7.230 | |

Null Hypothesis #4. Learning as measured by a posttest does not differ between groups of subjects in the fifth grade given different presentation and pacing techniques (group presentation and pacing or individual presentation and pacing). An F-ratio of 1.55 (df 1/58) for presentation and pacing technique is not significant. The data therefore fail to reject Null Hypothesis #4.

Null Hypothesis #5. Learning as measured by a posttest does not differ between groups of subjects in the fifth grade given different stimulus materials (original filmstrip or programed filmstrip with no confirmation for responses). An F-ratio of 1.46 (df 1/58) for stimulus materials is not significant. The data therefore fail to reject Null Hypothesis #5.

Null Hypothesis #6. Learning as measured by a posttest does not differ for stimulus materials (original filmstrip or programed filmstrip with no confirmation for responses) between presentation and pacing technique groups (group presentation and pacing or individual presentation and self-pacing) in the fifth grade. An F-ratio of less than unity (df 1/58) for interaction is not significant. The data therefore fail to reject Null Hypothesis #6.

Analysis C, Experiment I, compared the effects of presentation and pacing techniques with the effect of confirmation. In Analysis C, Experiment I, the coefficient of correlation of the adjusting variables and the dependent variable were as follows: chronological age--posttest $r = -.096$ and pretest--posttest $r = .041$. The adjusted mean scores for Analysis C, Experiment I, are shown in Table 6.

An analysis of covariance was performed which yielded the results summarized in Table 7.

TABLE 6. ADJUSTED MEAN SCORES FOR ANALYSIS C, EXPERIMENT I

| Confirmation | Presentation and pacing technique: Group | Presentation and pacing technique: Individual | Average mean |
|---|---|---|---|
| Confirmation | 11.075 | 7.515 | 9.295 |
| No confirmation | 8.432 | 9.290 | 8.861 |
| Average mean | 9.753 | 8.403 | 9.078 |

N = 64, n = 16

TABLE 7. ANALYSIS OF COVARIANCE ON POSTTEST SCORES FOR ANALYSIS C, EXPERIMENT I

| Source of variation | Degrees of freedom | Adjusted sum of squares | Mean squares | F |
|---|---|---|---|---|
| Presentation and pacing technique | 1 | 21.966 | 21.966 | 2.50 |
| Confirmation | 1 | 2.610 | 2.610 | .30 |
| Interaction | 1 | 64.640 | 64.640 | 7.34** |
| Within subgroups | 58 | 510.507 | 8.802 | |

**significant at the .01 level of confidence

Null Hypothesis #7. Learning as measured by a posttest does not differ between groups of subjects in the fifth grade given different presentation and pacing techniques (group presentation and pacing or individual presentation and self-pacing). An F-ratio of 2.50 (df 1/58) for presentation technique is not significant. The data therefore fail to reject Null Hypothesis #7.

Null Hypothesis #8. Learning as measured by a posttest does not differ between groups of subjects in the fifth grade given different amounts of confirmation (total confirmation or no confirmation). An F-ratio of .30 (df 1/58) for confirmation is not significant. The data therefore fail to reject Null Hypothesis #8.

Null Hypothesis #9. Learning as measured by a posttest does not differ for amount of confirmation (total confirmation or no confirmation) between presentation and pacing technique groups (group presentation and pacing or individual presentation and self-pacing) in the fifth grade. An F-ratio of 7.34 (df 1/58) for interaction is significant at the .01 level of confidence. The data therefore reject Null Hypothesis #9.

Scheffe's Test of Selected Contrasts was applied to the adjusted interaction mean scores for Analysis C, Experiment I. The results are shown in Table 8. The test revealed a difference of 3.559 (significant at the .05 level of confidence with df 1/58) between the P C G experimental group and the P C I experimental group.

TABLE 8. SCHEFFE'S TEST OF SELECTED CONTRASTS BETWEEN ADJUSTED INTERACTION MEAN SCORES FOR ANALYSIS C, EXPERIMENT I

| | P C G | P C I | P NC G |
|---|---|---|---|
| P C I | 3.559* | | |
| P NC G | 2.643 | .917 | |
| P NC I | 1.784 | 1.775 | .858 |

* significant at the .05 level of confidence

## Experiment II

Experiment II was identical to Experiment I except for the grade level of the subjects. Experiment II included one hundred and eight subjects in the seventh grade. Two scores were obtained for each subject: pretest score and posttest score. The chronological age and pretest scores were used as adjusting variables for the posttest scores. Three analyses were performed on the data in Experiment II. Analysis A compared the effects of presentation and pacing techniques with the original filmstrip and with the programed filmstrip with confirmation for responses. In Analysis A, Experiment II, the coefficient of correlation of the adjusting variables and the dependent variable were as follows: chronological age--posttest $r = -.003$ and pretest--posttest $r = .043$. The adjusted mean scores for Analysis A, Experiment II, are shown in Table 9. Raw data for Experiment II are reported in Appendix G.

TABLE 9. ADJUSTED MEAN SCORES FOR ANALYSIS A, EXPERIMENT II

| | Presentation and pacing technique | | |
|---|---|---|---|
| Stimulus materials | Group | Individual | Average mean |
| Original filmstrip | 11.688 | 9.255 | 10.471 |
| Programed filmstrip with confirmation | 12.457 | 14.600 | 13.529 |
| Average mean | 12.072 | 11.927 | 12.000 |

N = 72, n = 18

An analysis of covariance was performed which yielded the results summarized in Table 10.

TABLE 10. ANALYSIS OF COVARIANCE ON POSTTEST SCORES FOR ANALYSIS A, EXPERIMENT II

| Source of variation | Degrees of freedom | Adjusted sum of squares | Mean squares | F |
|---|---|---|---|---|
| Presentation and pacing technique | 1 | 0.308 | 0.308 | < 1.00 |
| Stimulus materials | 1 | 129.186 | 129.186 | 11.14** |
| Interaction | 1 | 67.335 | 67.335 | 5.80* |
| Within subgroups | 66 | 765.645 | 11.601 | |

** significant at the .01 level of confidence
* significant at the .05 level of confidence

Null Hypothesis #1. Learning as measured by a posttest does not differ between groups of subjects in the seventh grade given different presentation and pacing techniques (group presentation and pacing or individual presentation and self-pacing). An F-ratio of less than unity (df 1/66) for presentation and pacing technique is not significant. The data therefore fail to reject Null Hypothesis #1.

Null Hypothesis #2. Learning as measured by a posttest does not differ between groups of subjects in the seventh grade given different stimulus materials (original filmstrip or programed filmstrip with confirmation for responses). An F-ratio of 11.14 (df 1/66) for stimulus materials is significant at the .01 level of confidence. The data therefore reject Null Hypothesis #2.

Null Hypothesis #3. Learning as measured by a posttest does not differ for stimulus materials (original filmstrip or programed filmstrip with confirmation for responses) between presentation and pacing technique groups (group presentation and pacing or individual presentation and self pacing in the seventh grade). An F-ratio of 5.80 (df 1/66) for interaction is significant at the .05 level of confidence. The data therefore reject Null Hypothesis #3.

Scheffe's Test of Selected Contrasts was applied to the adjusted interaction mean scores for Analysis A, Experiment II. The results are shown in Table 11. The test revealed a difference of 5.345 (significant at the .01 level of confidence df 1/66) between the P C I experimental group and the O I experimental group.

TABLE 11. SCHEFFE'S TEST OF SELECTED CONTRASTS
BETWEEN ADJUSTED INTERACTION MEAN SCORES
FOR ANALYSIS A, EXPERIMENT II

| | O G | O I | P C G |
|---|---|---|---|
| O I | 2.433 | | |
| P C G | .769 | 3.202 | |
| P C I | 2.912 | 5.345** | 2.143 |

** significant at the .01 level of confidence

Analysis B, Experiment II, compared the effects of presentation and pacing techniques with both the original filmstrip and the programed filmstrip with no confirmation for responses. In Analysis B, Experiment II, the coefficient of correlation of the adjusting variables and the dependent variable were as follows: chronological age--posttest r = .023 and pretest--posttest r = .225. The adjusted mean scores for Analysis B, Experiment II, are shown in Table 12.

TABLE 12. ADJUSTED MEAN SCORES FOR ANALYSIS B, EXPERIMENT II

| Stimulus materials | Presentation and pacing technique: Group | Presentation and pacing technique: Individual | Average mean |
|---|---|---|---|
| Original filmstrip | 10.267 | 9.320 | 9.794 |
| Programed filmstrip with no confirmation | 14.894 | 12.685 | 13.790 |
| Average mean | 12.580 | 11.003 | 11.791 |

N = 72, n = 18

An analysis of covariance was performed which yielded the results summarized in Table 13.

TABLE 13. ANALYSIS OF COVARIANCE ON POSTTEST SCORES FOR ANALYSIS B, EXPERIMENT II

| Source of variation | Degrees of freedom | Adjusted sum of squares | Mean squares | F |
|---|---|---|---|---|
| Presentation technique | 1 | 40.083 | 40.083 | 3.27 |
| Stimulus materials | 1 | 278.233 | 278.233 | 22.68** |
| Interaction | 1 | 6.234 | 6.234 | < 1.00 |
| Within subgroups | 66 | 809.495 | 12.265 | |

** significant at the .01 level of confidence

Null Hypothesis #4. Learning as measured by a posttest does not differ between groups of subjects in the seventh grade given different presentation and pacing techniques (group presentation and pacing or individual presentation and self pacing). An F-ratio of 3.27 (df 1/66) for presentation and pacing technique is not significant. The data therefore fail to reject Null Hypothesis #4.

Null Hypothesis #5. Learning as measured by a posttest does not differ between groups of subjects in the seventh grade given different stimulus materials (original filmstrip or programed filmstrip with no confirmation for responses). An F-ratio of 22.68 (df 1/66) for stimulus materials is significant at the .01 level of confidence. The data therefore reject Null Hypothesis #5.

Null Hypothesis #6. Learning as measured by a posttest does not differ for stimulus materials (original filmstrip or programed filmstrip with no confirmation for responses) between presentation and pacing technique groups (group presentation and pacing or individual presentation and self pacing) in the seventh grade. An F-ratio of less than unity (df 1/66) for interaction is not significant. The data therefore fail to reject Null Hypothesis #6.

Analysis C, Experiment II, compared the effects of presentation and pacing techniques with the effect of confirmation. In Analysis C, Experiment II, the coefficient of correlation of the adjusting variables and the dependent variable were as follows: chronological age--posttest r = .098 and pretest--posttest r = .382. The adjusted mean scores for Analysis C, Experiment II, are shown in Table 14.

TABLE 14. ADJUSTED MEAN SCORES FOR ANALYSIS C, EXPERIMENT II

| Confirmation | Presentation and pacing technique: Group | Presentation and pacing technique: Individual | Average mean |
|---|---|---|---|
| Confirmation | 13.082 | 15.015 | 14.049 |
| No confirmation | 14.750 | 12.763 | 13.757 |
| Average mean | 13.916 | 13.889 | 13.902 |

N = 72, n = 18

An analysis of covariance was performed which yielded the results summarized in Table 15.

TABLE 15. ANALYSIS OF COVARIANCE ON POSTTEST SCORES FOR ANALYSIS C, EXPERIMENT II

| Source of variation | Degrees of freedom | Adjusted sum of squares | Mean squares | F |
|---|---|---|---|---|
| Presentation and pacing technique | 1 | 0.013 | 0.013 | < 1.00 |
| Confirmation | 1 | 1.294 | 1.294 | < 1.00 |
| Interaction | 1 | 67.426 | 67.426 | 3.94 |
| Within subgroups | 66 | 1128.915 | 17.105 | |

Null Hypothesis #7. Learning as measured by a posttest does not differ between groups of subjects in the seventh grade given different presentation and pacing techniques (group presentation and pacing or individual presentation and self pacing). An F-ratio of less than unity (df 1/66) for presentation and pacing technique is not significant. The data therefore fail to reject Null Hypothesis #7.

Null Hypothesis #8. Learning as measured by a posttest does not differ between groups of subjects in the seventh grade given different amounts of confirmation (total confirmation or no confirmation). An F-ratio of less than unity (df 1/66) for confirmation is not significant. The data therefore fail to reject Null Hypothesis #8.

Null Hypothesis #9. Learning as measured by a posttest does not differ for amount of confirmation (total confirmation or no confirmation) between presentation and pacing technique groups (group presentation and pacing or individual presentation and pacing) in the seventh grade. An F-ratio of 3.94 (df 1/66) for interaction is not significant. The data therefore fail to reject Null Hypothesis #9.

## Experiment III

Experiment III was identical to Experiments I and II except for the grade level of the subjects. Experiment III included one hundred and two subjects in the eleventh and twelfth grades. Two scores were obtained for each subject: pretest score and posttest score. The chronological age and pretest score of each subject were used as adjusting variables for the posttest scores. Three analyses were performed on the data in Experiment III. Analysis A compared the effects of presentation and pacing techniques with the original filmstrip and with the programed filmstrip with confirmation for responses. In Analysis A, Experiment III, the coefficient of correlation of the adjusting variables and the dependent variable were as follows: chronological age--posttest r = -.155 and pretest-posttest r = .263.

The adjusted mean scores for Analysis A, Experiment III, are shown in Table 16. Raw data for Experiment III are reported in Appendix H.

TABLE 16. ADJUSTED MEAN SCORES FOR ANALYSIS A, EXPERIMENT III

| Stimulus materials | Presentation and pacing technique: Group | Presentation and pacing technique: Individual | Average mean |
|---|---|---|---|
| Original filmstrip | 12.245 | 10.031 | 11.138 |
| Programed filmstrip with confirmation | 14.304 | 15.654 | 14.979 |
| Average mean | 13.275 | 12.843 | 13.058 |

N = 68, n = 18

An analysis of covariance was performed which yielded the results summarized in Table 17.

TABLE 17. ANALYSIS OF COVARIANCE ON POSTTEST SCORES FOR ANALYSIS A, EXPERIMENT III

| Source of variation | Degrees of freedom | Adjusted sum of squares | Mean squares | F |
|---|---|---|---|---|
| Presentation and pacing technique | 1 | 3.063 | 3.063 | < 1.00 |
| Stimulus materials | 1 | 210.869 | 210.869 | 10.26** |
| Interaction | 1 | 53.618 | 53.618 | 2.61 |
| Within subgroups | 62 | 1,273.979 | 20.548 | |

** significant at the .01 level of confidence

Null Hypothesis #2. Learning as measured by a posttest does not differ between groups of subjects in the eleventh and twelfth grades given different stimulus materials (original filmstrip or programed filmstrip with confirmation for responses). An F-ratio of 10.26 (df 1/62) for stimulus materials is significant at the .01 level of confidence. The data therefore reject Null Hypothesis #2.

Null Hypothesis #3. Learning as measured by a posttest does not differ for stimulus materials (original filmstrip or programed filmstrip with confirmation for responses) between presentation and pacing technique groups (group presentation and pacing or individual presentation and self pacing) in the eleventh and twelfth grades. An F-ratio of 2.61 (df 1/62) for interaction is not significant. The data therefore fail to reject Null Hypothesis #3.

Analysis B, Experiment III, compared the effects of presentation and pacing techniques with both the original filmstrip and the programed filmstrip with no confirmation for responses. In Analysis B, Experiment III, the coefficient of correlation of the adjusting variables and the dependent variable were as follows: chronological age--posttest r = -.067 and pretest--posttest r = .235. The adjusted mean scores for Analysis B, Experiment III, are shown in Table 18.

TABLE 18. ADJUSTED MEAN SCORES FOR ANALYSIS B, EXPERIMENT III

| | Presentation and pacing technique | | |
|---|---|---|---|
| Stimulus materials | Group | Individual | Average mean |
| Original filmstrip | 12.278 | 10.117 | 11.198 |
| Programed filmstrip with no confirmation | 14.984 | 15.091 | 15.038 |
| Average mean | 13.631 | 12.604 | 13.117 |

N = 68, n = 18

An analysis of covariance was performed which yielded the results summarized in Table 19.

TABLE 19. ANALYSIS OF COVARIANCE ON POSTTEST SCORES FOR ANALYSIS B, EXPERIMENT III

| Source of variation | Degrees of freedom | Adjusted sum of squares | Mean squares | F |
|---|---|---|---|---|
| Presentation and pacing technique | 1 | 14.364 | 14.364 | < 1.00 |
| Stimulus material | 1 | 231.371 | 231.371 | 12.83** |
| Interaction | 1 | 19.287 | 19.287 | 1.07 |
| Within subgroups | 62 | 1,119.006 | 18.032 | |

** significant at the .01 level of confidence

Null Hypothesis #4. Learning as measured by a posttest does not differ between groups of subjects in the eleventh and twelfth grades given different presentation and pacing techniques (group presentation and pacing or individual presentation and self pacing). An F-ratio of less than unity (df 1/62) for presentation and pacing technique is not significant. The data therefore fail to reject Null Hypothesis #4.

Null Hypothesis #5. Learning as measured by a posttest does not differ between groups of subjects in the eleventh and twelfth grades given different stimulus materials (original filmstrip or programed filmstrip with no confirmation for responses). An F-ratio of 12.83 (df 1/62) for stimulus materials is significant at the .01 level of confidence. The data therefore reject Null Hypothesis #5.

Null Hypothesis #6. Learning as measured by a posttest does not differ for stimulus materials (original filmstrip or programed filmstrip with no confirmation for responses) between presentation and pacing technique groups (group presentation and pacing or individual presentation and self pacing) in the eleventh and twelfth grade. An F-ratio of 1.07 (df 1/62) for interaction is not significant. The data therefore fail to reject Null Hypothesis #6.

Analysis C, Experiment III, compared the effects of presentation and pacing techniques with the effect of confirmation. In Analysis C, Experiment III, the coefficient of correlation of the adjusting variables and the dependent variable were as follows: chronological age--posttest r = -.067 and pretest--posttest r = .235. The adjusted mean scores for Analysis C, Experiment III, are shown in Table 20.

TABLE 20. ADJUSTED MEAN SCORES FOR ANALYSIS C, EXPERIMENT III

| | Presentation and pacing technique | | |
|---|---|---|---|
| Confirmation | Group | Individual | Average mean |
| Confirmation | 14.068 | 15.542 | 14.805 |
| No confirmation | 15.702 | 14.804 | 15.253 |
| Average mean | 14.885 | 15.173 | 15.029 |

N = 68, n = 18

An analysis of covariance was performed which yielded the results summarized in Table 21.

TABLE 21. ANALYSIS OF COVARIANCE ON POSTTEST SCORES FOR ANALYSIS C, EXPERIMENT III

| Source of variation | Degrees of freedom | Adjusted sum of squares | Mean squares | F |
|---|---|---|---|---|
| Presentation and pacing technique | 1 | 1.105 | 1.105 | < 1.00 |
| Confirmation | 1 | 3.221 | 3.221 | < 1.00 |
| Interaction | 1 | 21.286 | 21.286 | 1.04 |
| Within subgroups | 62 | 1,268.708 | 20.463 | |

Null Hypothesis #7. Learning as measured by a posttest does not differ between groups of subjects in the eleventh and twelfth grades given different presentation and pacing techniques (group presentation and pacing or individual presentation and self pacing). An F-ratio of less than unity (df 1/62) for presentation and pacing technique is not significant. The data therefore fail to reject Null Hypothesis #7.

Null Hypothesis #8. Learning as measured by a posttest does not differ between groups of subjects in the eleventh and twelfth grades given different amounts of confirmation (total confirmation or no confirmation). An F-ratio of less than unity (df 1/62) for confirmation is not significant. The data therefore fail to reject Null Hypothesis #8.

Null Hypothesis #9. Learning as measured by a posttest does not differ for amount of confirmation (total confirmation or no confirmation) between presentation and pacing technique groups (group presentation and pacing or individual presentation and self pacing) in the eleventh and twelfth grades. An F-ratio of 1.04 (df 1/62) for interaction is not significant. The data therefore fail to reject Null Hypothesis #9.

# CHAPTER IV

# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## Summary

Three experiments were conducted to determine the effect upon posttest scores of: (a) stimulus materials (programed filmstrip or original filmstrip), (b) confirmation (immediate confirmation or no confirmation), and (c) presentation and pacing technique (individual viewing and self pacing or group viewing and pacing). The content selected for the study was the first thirty-two frames of the filmstrip Earth's Satellite--The Moon produced by the Society for Visual Education. The content in each frame of the original filmstrip was broken down into very small bits of information. Each small bit of information was then written into a separate frame of the programed filmstrip. Multiple choice questions were inserted after each content frame of the programed filmstrip to cause the subjects to respond actively to each bit of information that had been presented to them. The original filmstrip consisted of thirty-two frames, and the programed filmstrip consisted of ninety-two frames. However, both filmstrips contained the same content.

Each subject who viewed the programed filmstrip was provided with a Rapid-Rater on which he could register his responses for each multiple choice question. The Rapid-Rater could be adjusted so that the subjects received confirmation for each response or so that they did not receive confirmation for each response depending upon the assigned experimental treatment.

Two types of presentation and pacing technique were used: (a) group viewing and pacing and (b) individual viewing and self pacing. The group viewing and pacing was quite similar to regular classroom use of a filmstrip. Individual viewing and self pacing was provided by using individual filmstrip viewers.

The combinations of these variables and intervals of each variable resulted in six experimental treatments for each grade level:

1. P C G--The stimulus material was the programed filmstrip. Each subject received immediate confirmation for each of his responses and viewed the filmstrip in a group.

2. P C I--The stimulus material was the programed filmstrip. Each subject received immediate confirmation of his responses and viewed and paced the filmstrip individually.

3. P NC G--The stimulus material was the programed filmstrip. The subjects received no confirmation of responses and viewed filmstrip in a group.

4. P NC I--The stimulus material was the programed filmstrip. The subjects received no confirmation of responses and viewed and paced the filmstrip individually.

5. O G--The stimulus material was the original filmstrip. The subjects viewed the filmstrip in a group.

6. O I--The stimulus material was the original filmstrip. The subjects viewed and paced the filmstrip individually.

Experiment I included ninety-six subjects in the fifth grade, Experiment II included one hundred and eight subjects in the seventh grade, and Experiment III included one hundred and two subjects in the eleventh and twelfth grades. The subjects in each classroom were randomly assigned to one of the six experimental treatments. In each case the classroom teacher acted as a supervisor for the children who were not being treated by the experimenters at that time. The investigators of the study conducted all of the experimental treatments in all cases.

Two adjusting variables and one dependent variable were used in the study. The chronological age and pretest score of each subject were the adjusting variables, and the posttest score of each subject was the dependent variable. Analysis of covariance was used for testing the hypotheses. Where analysis of covariance revealed significant differences attributable to interaction between two independent variables, Scheffe's Test of Selected Contrasts was employed to determine significant differences among the four experimental treatments. The hypotheses were rejected at the .05 level of confidence.

Experiment I. It was found that children in the fifth grade learned more from the programed filmstrip with confirmation shown in a group than did the children who used the programed filmstrip with confirmation individually. Although not significant the rank order of the experimental treatments from high mean score to low mean score in this analysis was as follows: P C G, P NC I, P NC G, and P C I. A significant interaction was also found when comparing P C G, P C I, O G, and O I. However, Scheffe's Test of Selected Contrasts did not reveal any significant differences among these experimental treatments. The rank order of the treatments from high mean score to low mean score, although not significant, was as follows: P C G, O I, O G, and P C I.

Experiment II. The analyses of the data from the seventh grade subjects showed that the children using the programed filmstrip with confirmation learned more than those children using the original filmstrip (.01 level of confidence). Further the data showed that the subjects using the programed filmstrip with no confirmation also learned more than did those subjects who used the original filmstrip (.01 level of confidence). The interaction among P C G, P C I, O G, and O I was also found to be significant at the .05 level of confidence. Scheffe's Test of Selected Contrasts further revealed that the programed filmstrip with confirmation used individually caused a significantly higher mean score than did the original filmstrip used individually (.01 level of confidence). The rank order of these experimental treatments from high mean score to low mean score, although not significant, was as follows: P C I, P C G, O G, and O I.

Experiment III. This experiment revealed that subjects at the eleventh and twelfth grade levels learned significantly more with programed filmstrip with confirmation than similar subjects learned with the original filmstrip (.01 level of confidence). The analyses further showed that the subjects learned more with the programed filmstrip with no confirmation than did similar subjects with the original filmstrip (.01 level of confidence).

Stimulus Materials. Experiments II and III both showed that subjects using the programed filmstrip with confirmation learned more than the subjects using the original filmstrip (.01 level of confidence). Experiments II and III further showed that the programed filmstrip with no confirmation for responses resulted in a higher mean score than did the original filmstrip (.01 level of confidence).

*Confirmation*. None of the analyses in any of the three experiments showed that confirmation itself was a significant factor in learning. Even though it was found that the programed filmstrip with confirmation caused a higher mean score than the original filmstrip (Experiments II and III), it was also found that the programed filmstrip with no confirmation resulted in a higher mean score than did the original filmstrip (Experiments II and III). A comparison of the data from subjects who had received confirmation and those who had not received confirmation using the same programed filmstrip did not reveal any significant differences.

*Presentation and Pacing Technique*. None of the three experiments revealed significant differences which could be attributed to the presentation and pacing techniques.

*Interactions*. Significant interactions were found in both Experiments I and II. In Experiment I a comparison of P C G, P C I, O G, and O I revealed a significant interaction. However, Scheffe's Test of Selected Contrasts did not reveal any of these differences to be significant. The same analyses on Experiment II revealed that P C I caused a higher mean score than did O I (.01 level of confidence). Another analysis on Experiment I revealed that P C G resulted in a higher mean score than did P C I.

## Conclusions

From the significant differences found in investigating the previously formulated hypotheses, certain conclusions can be drawn. The conclusions are first presented as they relate to the grade level of the subjects and then as they related to stimulus materials, confirmation, presentation and pacing techniques.

Experiment I. From the findings of the study it could be concluded that at the fifth grade level programed materials with confirmation used in a group presentation and pacing technique are more effective than the same programed materials with confirmation used in an individual presentation and pacing technique. It should be emphasized that the individual viewing and pacing required each subject to read all captions and questions individually; whereas the proctor read the captions and question to the group paced subjects. Thus the reading ability of the fifth grade subjects was an important factor in this situation. In some cases it was discovered informally that several of the words used in the filmstrip were not in the vocabulary of the fifth grade subjects.

Experiment II. It could be concluded from this experiment that at the seventh grade level programed filmstrips (whether confirmation is given or whether it is not given) are more effective than non-programed filmstrips. From this study it was not possible to tell whether these materials should be presented in a group or individually.

Experiment III. As in Experiment II it could be concluded that at the eleventh and twelfth grade levels (whether confirmation is given or whether it is not given) programed filmstrip materials are more effective than non-programed filmstrip materials.

Stimulus Materials. It could be concluded on the basis of the experiments reported here that filmstrip materials programed in the manner described are more effective than are non-programed filmstrip materials.

Presentation and Pacing Techniques. On the basis of these three experiments no conclusions could be drawn about the effect of individual presentation and pacing or group presentation and pacing. The results of these experiments were confounded by the presence of narration on the group presentation and pacing experimental treatments and the lack of narration on the individual presentation and pacing experimental treatments.

## Recommendations

The findings of this study have certain implications for teachers' selection and use of filmstrip materials. The findings also reaffirm previous research findings regarding the production of educational filmstrips. First, filmstrip captions should always be read to fifth grade students. Second, care should be exercised in the production of filmstrips so that each frame contains only one bit of information and so that opportunity is provided for active responses to each bit of information. This opportunity may be built into the filmstrip or provided by the utilization techniques of the classroom teacher. Third, when given a choice, teachers should select filmstrips which have undergone preproduction revisions on the basis of typical student reactions and responses.

Several questions were raised at the outset of this study, some of which were answered and some of which were not investigated sufficiently to find an answer. Those that are still to be answered are as important as those which were answered if the knowledge of learning from verbal and pictorial materials is to be advanced to its maximum. The investigators recommend further study in the following areas as a step in furthering the knowledge of applying programing techniques to filmstrip materials.

Stimulus Materials. A comparison was made between a commercial filmstrip and a "programed filmstrip." The programing technique applied to this content was the breaking down of the original frames of the filmstrip to smaller frames or single bits of information. It was found that learning increased when the material was presented in small bits, but this change is only one of the manipulations which are possible with verbal and pictorial materials. For example, is there competition between the pictorial and caption material of a frame? Does the caption and the picture appearing on the screen at the same time cause the subjects' attention to move between the caption and the pictorial part of the frame? Would the subjects learn more if they were shown only the pictorial portion of the frame and had the captions read to them orally? What are the interrelationships of verbal-pictorial stimuli and abstract or concrete content? Is it effective to teach concrete content by means of verbal material or would concrete content be taught better by pictorial stimuli? Should abstract content be taught using verbal stimuli or pictorial stimuli? Would the subjects have gained as much by having the captions read to them without the visuals being shown to them at all?

It was found in all replications of the study except at the fifth grade level that the programed filmstrip was superior to the commercial filmstrip. Was this difference caused by breaking the information into small bits of information or was it caused by requiring the subjects to respond to each bit of information which had been presented? This study does not sufficiently answer these questions in relation to stimulus materials.

Confirmation. This study investigated only one minor modality of confirmation--the depth of penetration and size of hole made by a stylus when pushed through an answer sheet. Are there other types of mechanical confirmation which would be more effective? How does this type compare with personal confirmation from a teacher to each student individually and privately? How would private confirmation compare with public confirmation before the student's peers?

Presentation and Pacing. The study provided two means of pacing subjects through the stimulus material--group pacing or self pacing. The group pacing treatment included group showing of the filmstrip and oral reading of the captions which appeared on the screen. The self pacing treatment naturally did not include an oral presentation of the printed matter to the subjects. If one were to present orally the printed matter then it would no longer be self paced by the subjects. This in itself caused a confounding of variables inasmuch as the investigators could not determine whether it was the oral presentation of the printed captions or the pacing of the materials which caused a difference in learning from the materials. It is recommended that the self pacing variable be investigated further to see if under similar situations, that is, if narration is provided for both self pacing (with the subject having as much control as possible over the rate) and group pacing if learning would differ.

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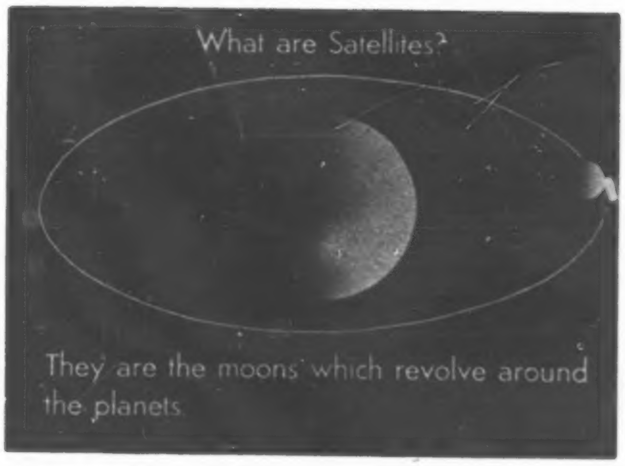
# APPENDIX A

## Stimulus Materials

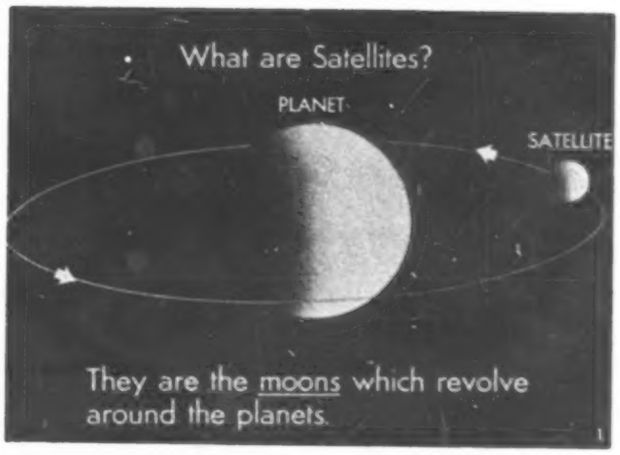
### Original Filmstrip



What are Satellites?

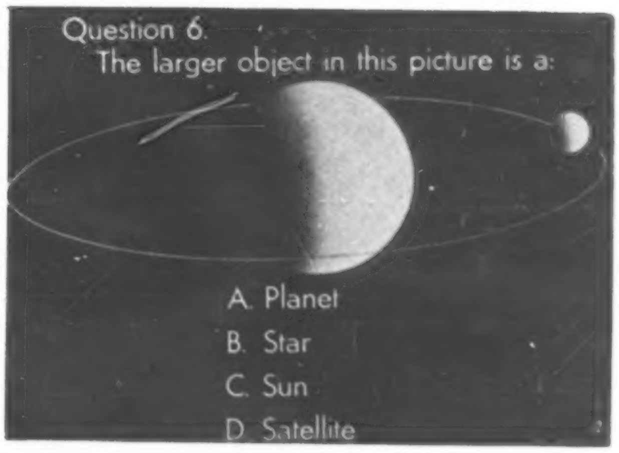
They are the moons which revolve around the planets.

### Programed Filmstrip



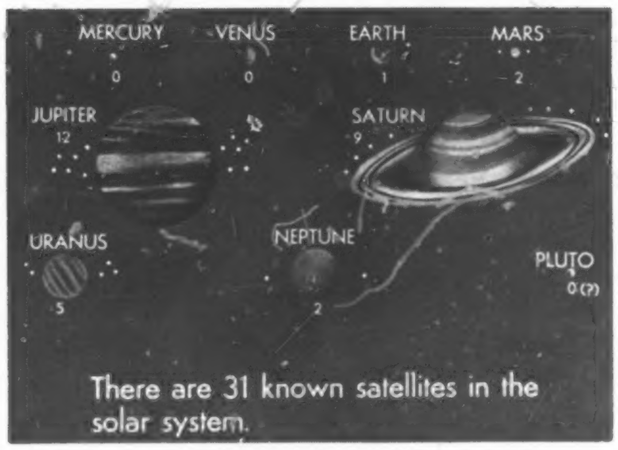
What are Satellites?

They are the moons which revolve around the planets.

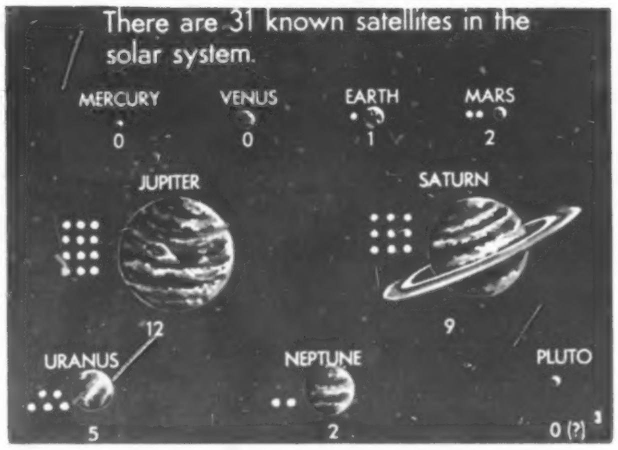


Question 6.
The larger object in this picture is a:

A. Planet
B. Star
C. Sun
D. Satellite

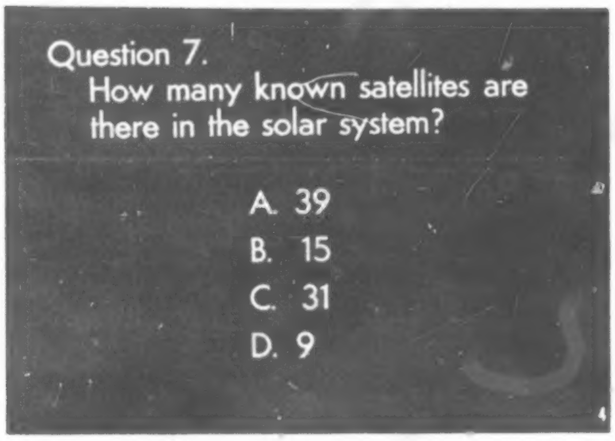

MERCURY
0
VENUS
0
EARTH
1
MARS
2
JUPITER
12
SATURN
9
URANUS
5
NEPTUNE
2
PLUTO
0 (?)

There are 31 known satellites in the solar system.



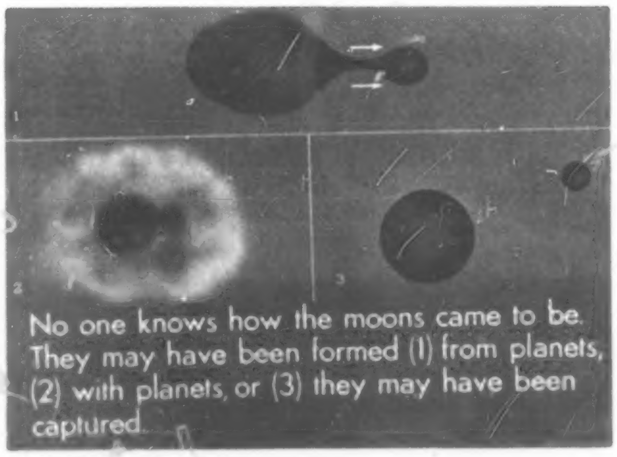
There are 31 known satellites in the solar system.

MERCURY
0
VENUS
0
EARTH
1
MARS
2
JUPITER
12
SATURN
9
URANUS
5
NEPTUNE
2
PLUTO
0 (?)
3

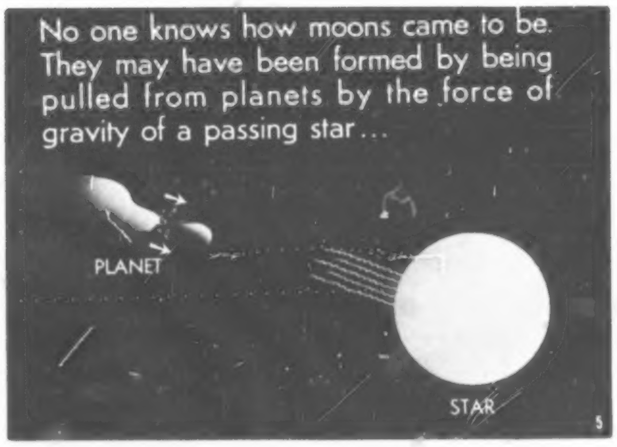


Question 7.
How many known satellites are there in the solar system?

A. 39
B. 15
C. 31
D. 9

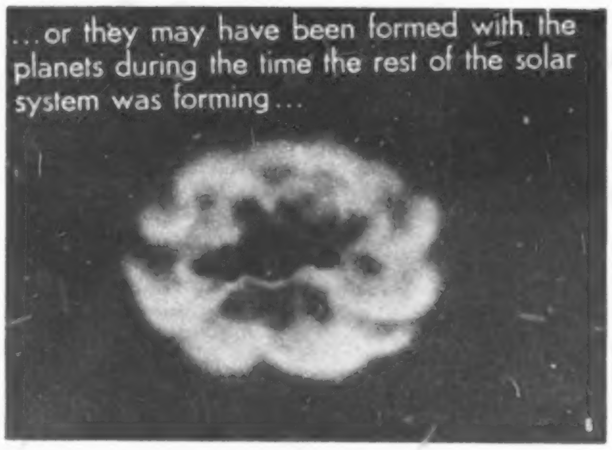


No one knows how the moons came to be. They may have been formed (1) from planets, (2) with planets, or (3) they may have been captured.

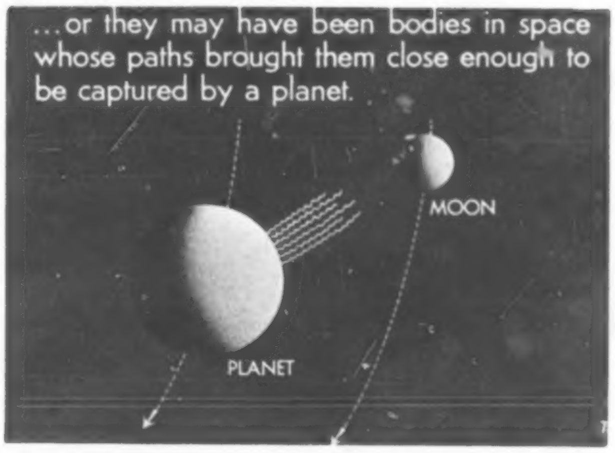


No one knows how moons came to be. They may have been formed by being pulled from planets by the force of gravity of a passing star...

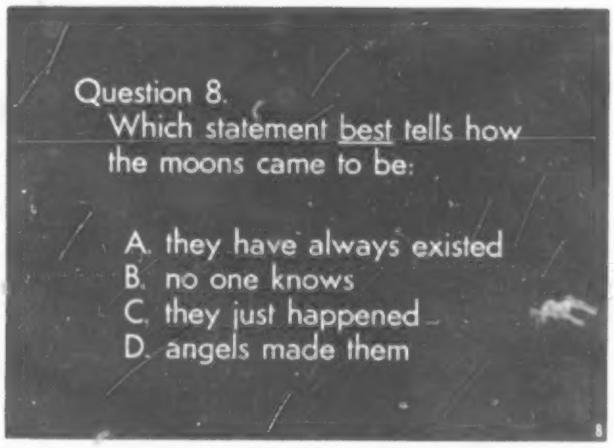
PLANET
STAR
5



...or they may have been formed with the planets during the time the rest of the solar system was forming...

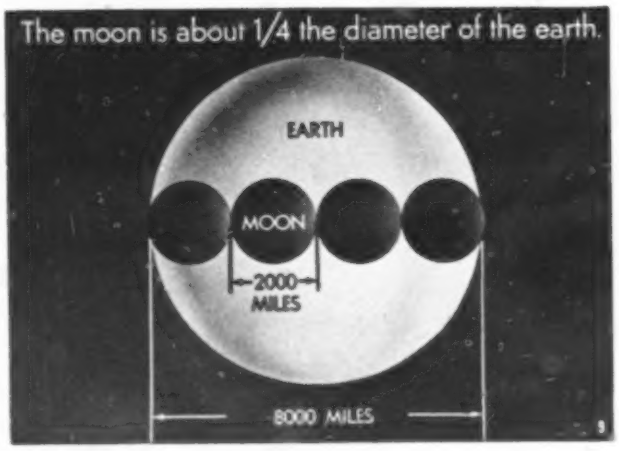


...or they may have been bodies in space whose paths brought them close enough to be captured by a planet.



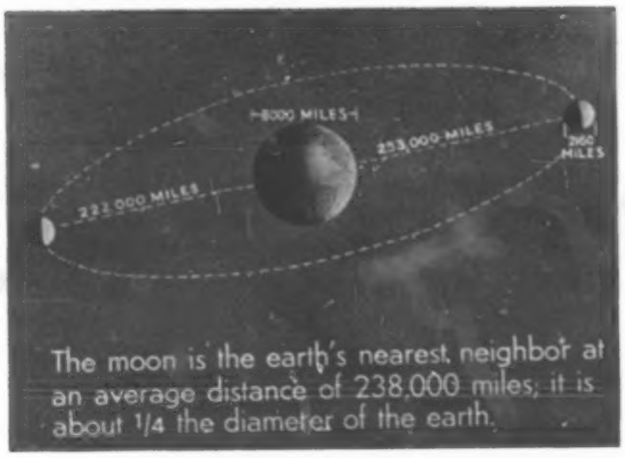
Question 8.
Which statement best tells how the moons came to be:

A. they have always existed
B. no one knows
C. they just happened
D. angels made them



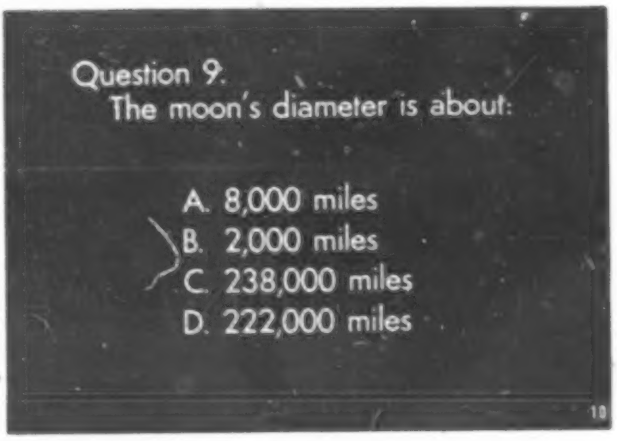
The moon is about 1/4 the diameter of the earth.

EARTH
MOON
2000 MILES
8000 MILES
9



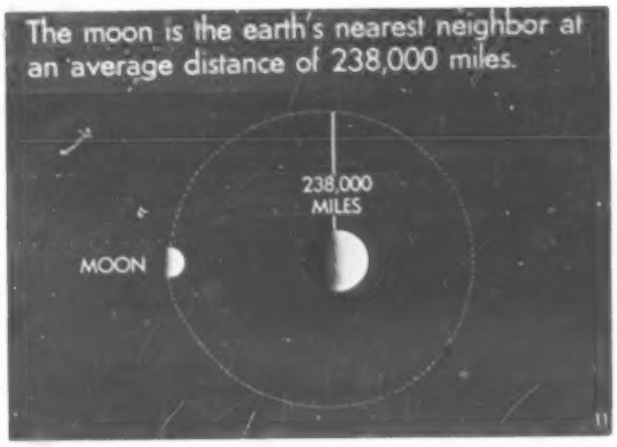
The moon is the earth's nearest neighbor at an average distance of 238,000 miles; it is about 1/4 the diameter of the earth.

8000 MILES
253,000 MILES
2160 MILES
222,000 MILES



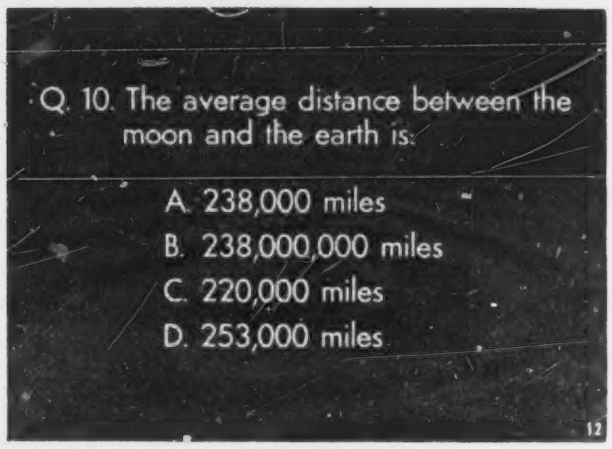
Question 9.
The moon's diameter is about:

A. 8,000 miles
B. 2,000 miles
C. 238,000 miles
D. 222,000 miles



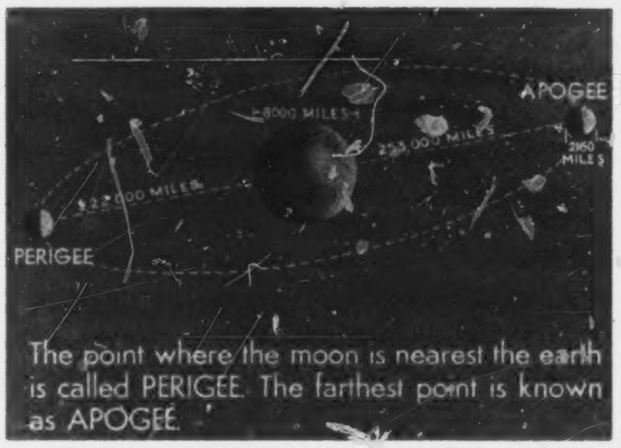
The moon is the earth's nearest neighbor at an average distance of 238,000 miles.

238,000 MILES
MOON
11

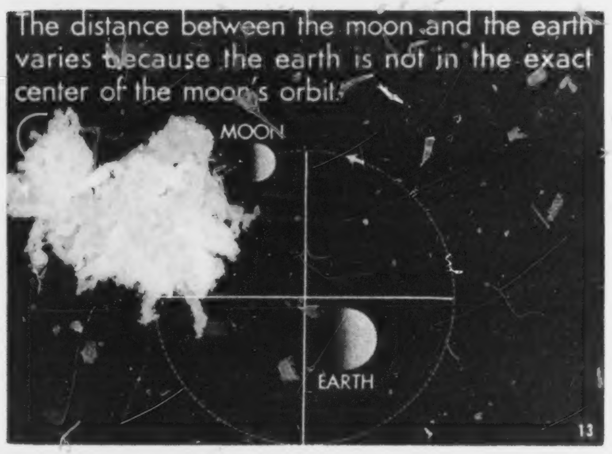


Q. 10. The average distance between the moon and the earth is:

A. 238,000 miles
B. 238,000,000 miles
C. 220,000 miles
D. 253,000 miles

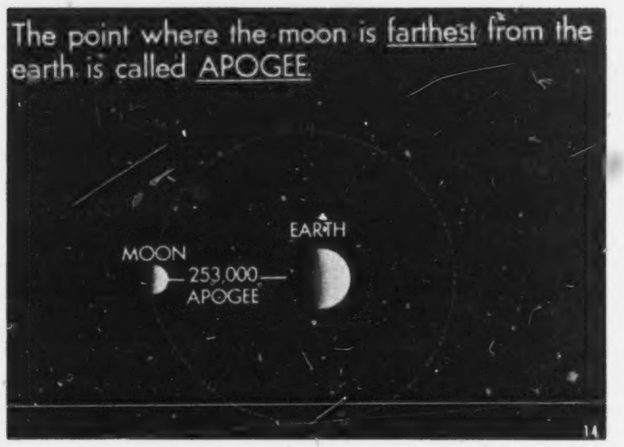

APOGEE
8000 MILES
253,000 MILES
2160 MILES
222,000 MILES
PERIGEE

The point where the moon is nearest the earth is called PERIGEE. The farthest point is known as APOGEE.



The distance between the moon and the earth varies because the earth is not in the exact center of the moon's orbit.

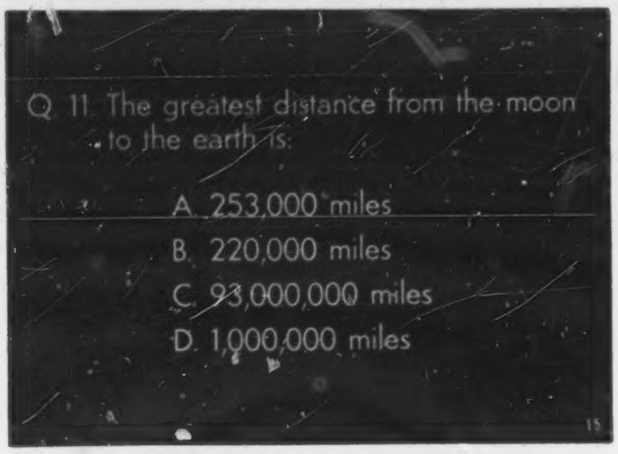
MOON
EARTH
13



The point where the moon is farthest from the earth is called APOGEE.

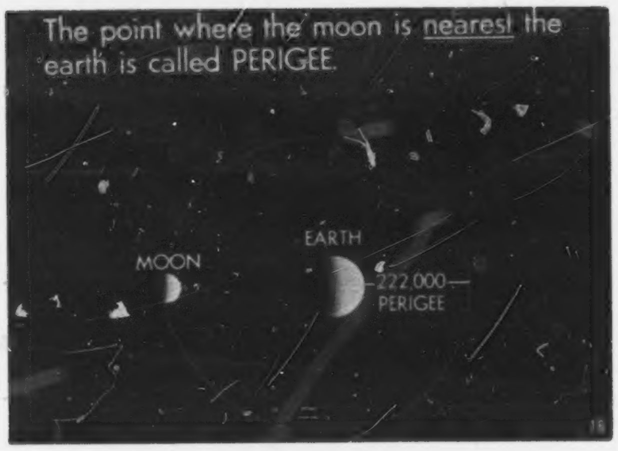
EARTH
MOON
253,000
APOGEE
14

2



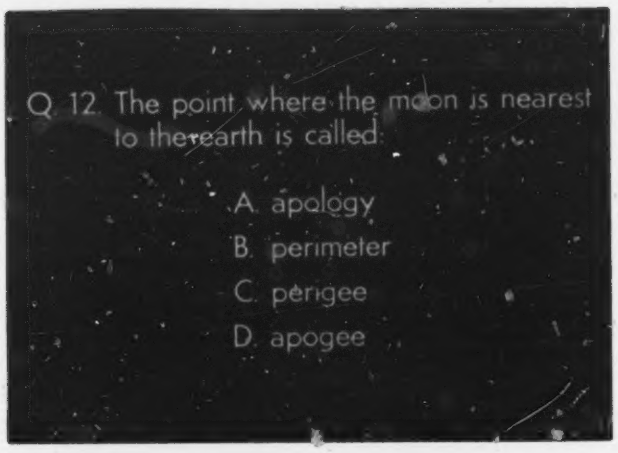
Q. 11. The greatest distance from the moon to the earth is:

A. 253,000 miles
B. 220,000 miles
C. 93,000,000 miles
D. 1,000,000 miles



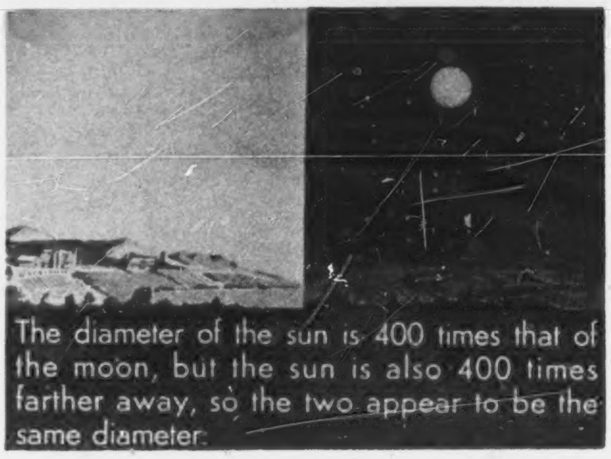
The point where the moon is nearest the earth is called PERIGEE.

MOON
EARTH
222,000—
PERIGEE
16

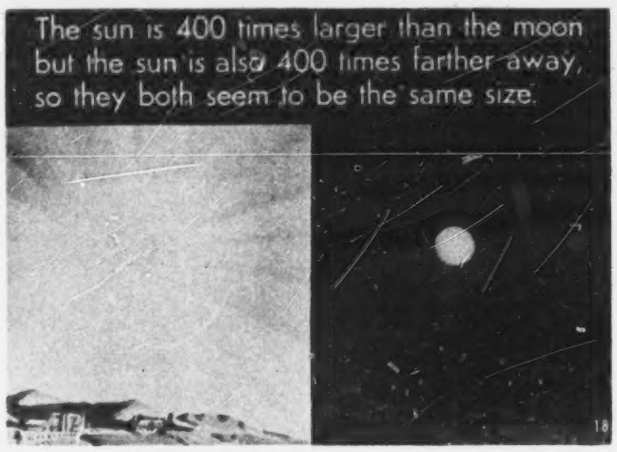


Q. 12. The point where the moon is nearest to the earth is called:

A. apology
B. perimeter
C. perigee
D. apogee

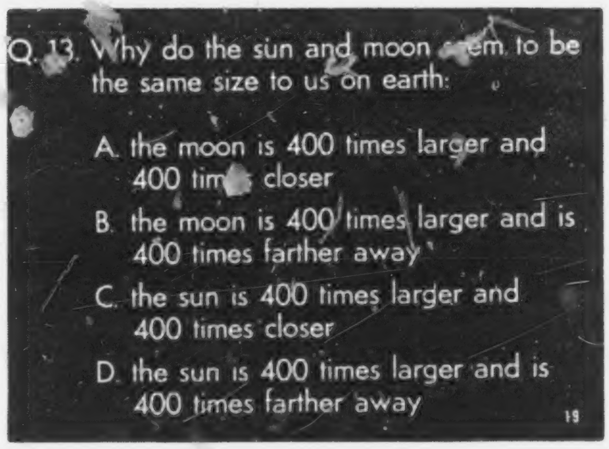


The diameter of the sun is 400 times that of the moon, but the sun is also 400 times farther away, so the two appear to be the same diameter.



The sun is 400 times larger than the moon but the sun is also 400 times farther away, so they both seem to be the same size.

18



Q. 13. Why do the sun and moon seem to be the same size to us on earth:

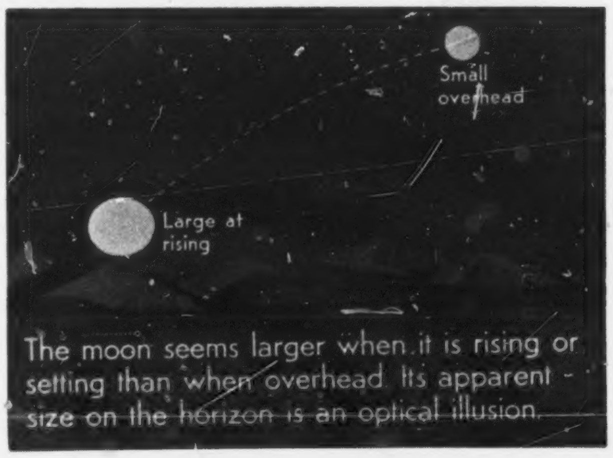
A. the moon is 400 times larger and 400 times closer

B. the moon is 400 times larger and is 400 times farther away

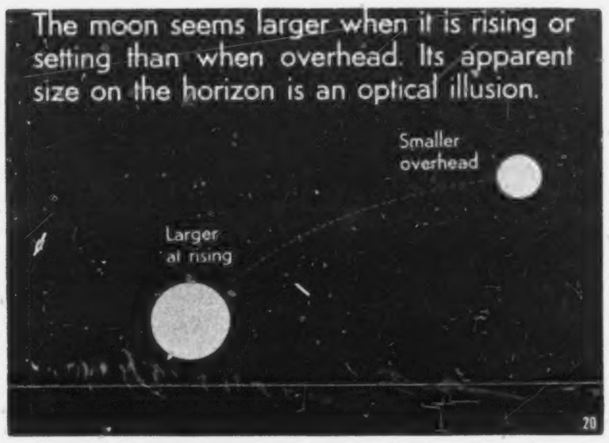
C. the sun is 400 times larger and 400 times closer

D. the sun is 400 times larger and is 400 times farther away

19



The moon seems larger when it is rising or setting than when overhead. Its apparent size on the horizon is an optical illusion.

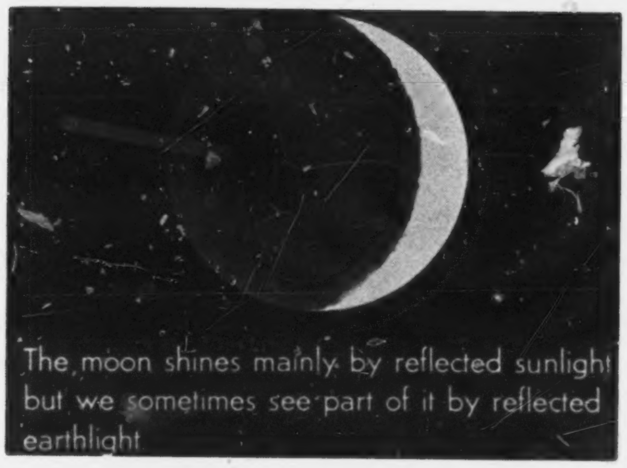


The moon seems larger when it is rising or setting than when overhead. Its apparent size on the horizon is an optical illusion.

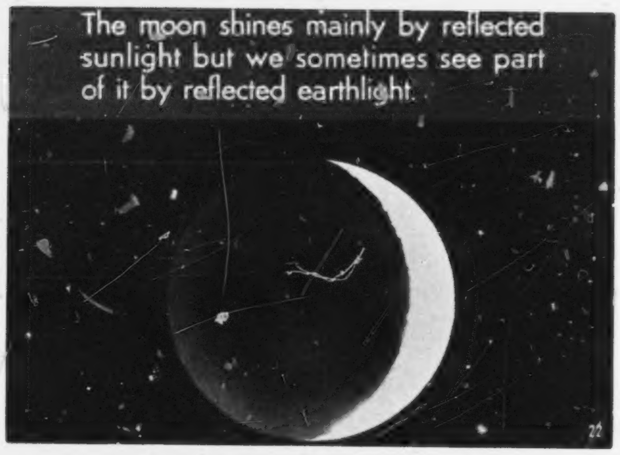
20

Q. 14. The apparent size of the moon on the horizon is explained by:

A. nearsightedness
B. farsightedness
C. optical illusion
D. optical defects



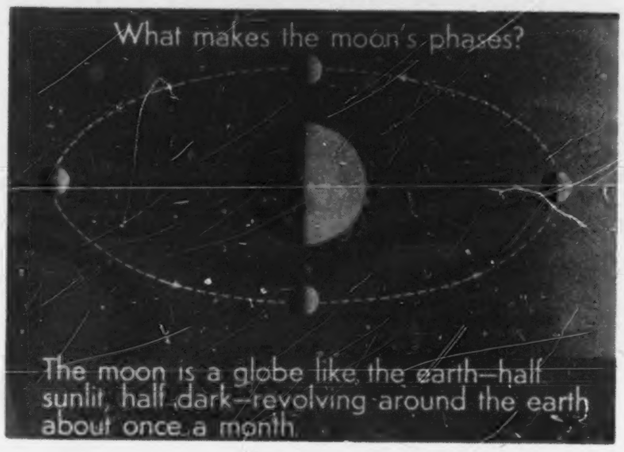
The moon shines mainly by reflected sunlight but we sometimes see part of it by reflected earthlight



The moon shines mainly by reflected sunlight but we sometimes see part of it by reflected earthlight.

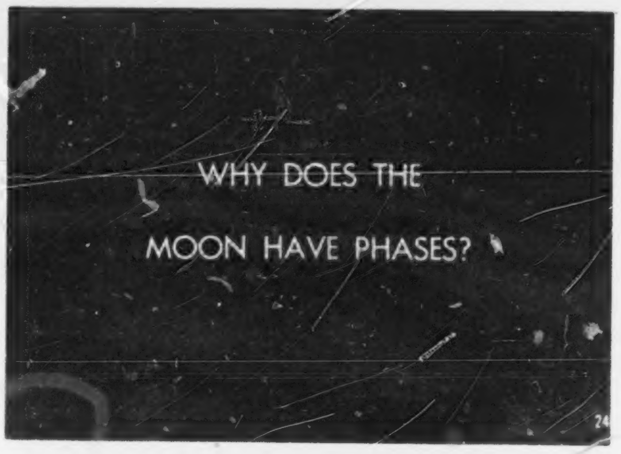
Q. 15. The moon shines mainly because:

A. it is on fire
B. it reflects sunlight
C. it is made of glowing matter
D. it has radium in its composition



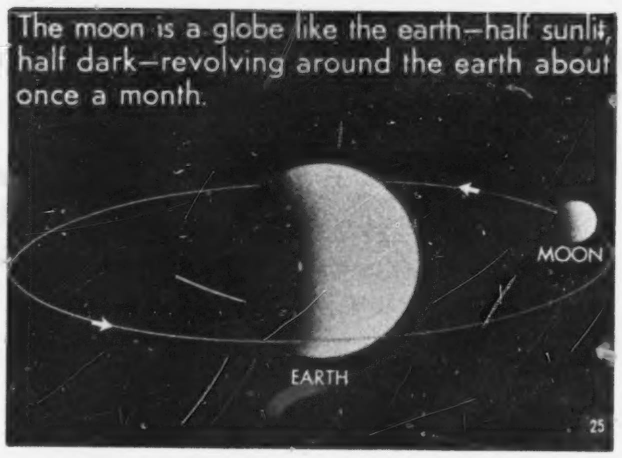
What makes the moon's phases?

The moon is a globe like the earth—half sunlit, half dark—revolving around the earth about once a month.

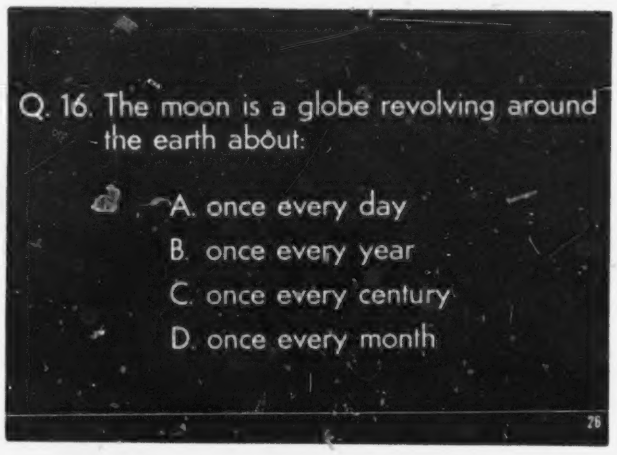


WHY DOES THE

MOON HAVE PHASES?

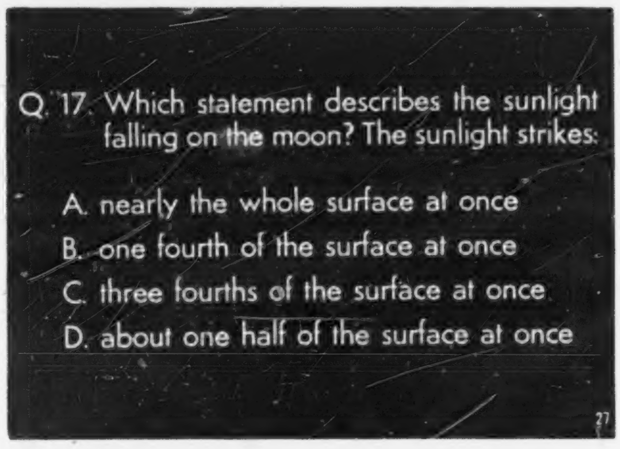


The moon is a globe like the earth—half sunlit, half dark—revolving around the earth about once a month.



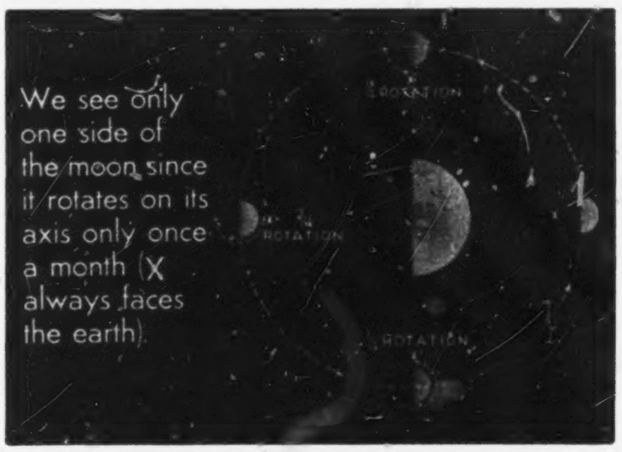
Q. 16. The moon is a globe revolving around the earth about:

A. once every day
B. once every year
C. once every century
D. once every month



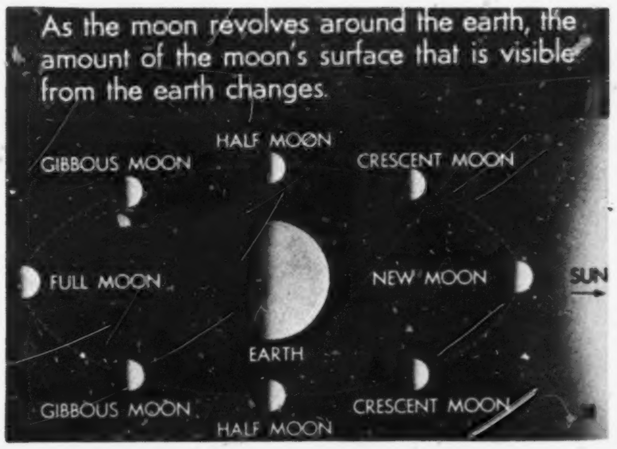
Q. 17. Which statement describes the sunlight falling on the moon? The sunlight strikes:

A. nearly the whole surface at once
B. one fourth of the surface at once
C. three fourths of the surface at once
D. about one half of the surface at once



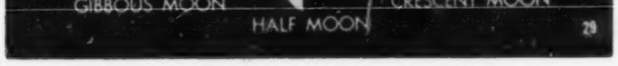
We see only one side of the moon since it rotates on its axis only once a month (X always faces the earth).

ROTATION
ROTATION
ROTATION



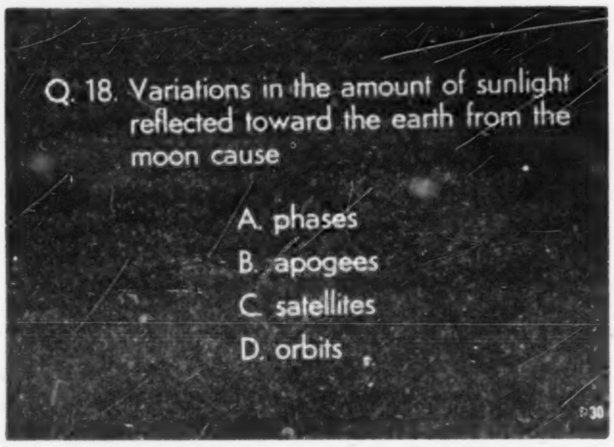
As the moon revolves around the earth, the amount of the moon's surface that is visible from the earth changes.

HALF MOON
GIBBOUS MOON
CRESCENT MOON
FULL MOON
NEW MOON
SUN
EARTH
GIBBOUS MOON
CRESCENT MOON
HALF MOON



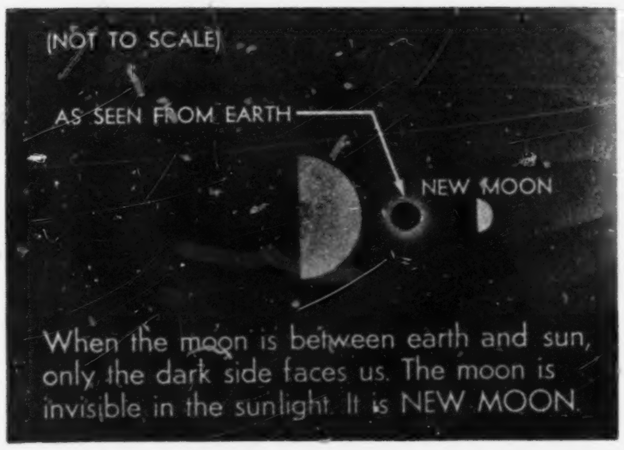
These apparent changes are called PHASES. From the earth they appear like this:

HALF MOON
GIBBOUS MOON
CRESCENT MOON
FULL MOON
NEW MOON
EARTH
GIBBOUS MOON
CRESCENT MOON
HALF MOON
29



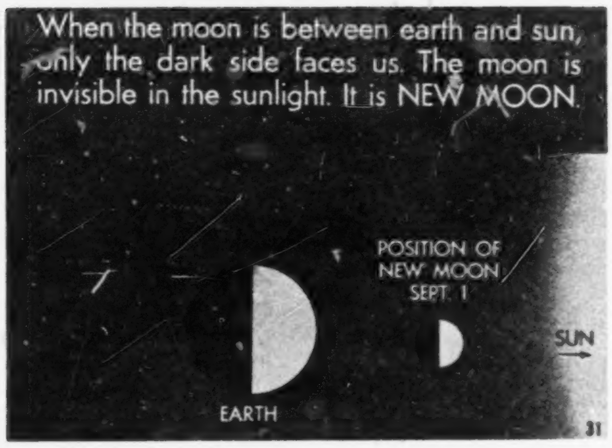
Q. 18. Variations in the amount of sunlight reflected toward the earth from the moon cause

A. phases
B. apogees
C. satellites
D. orbits



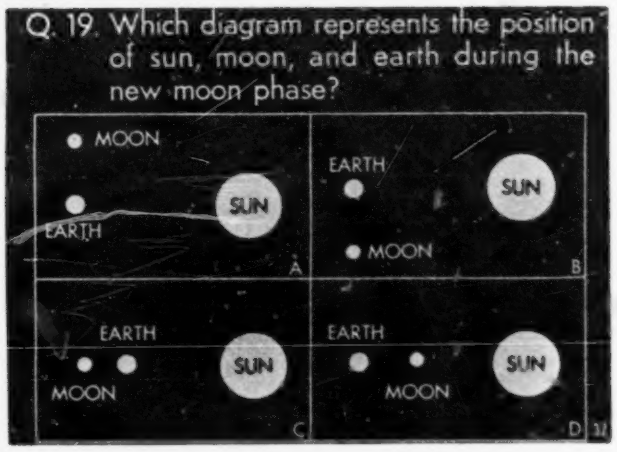
(NOT TO SCALE)
AS SEEN FROM EARTH
NEW MOON

When the moon is between earth and sun, only the dark side faces us. The moon is invisible in the sunlight. It is NEW MOON.



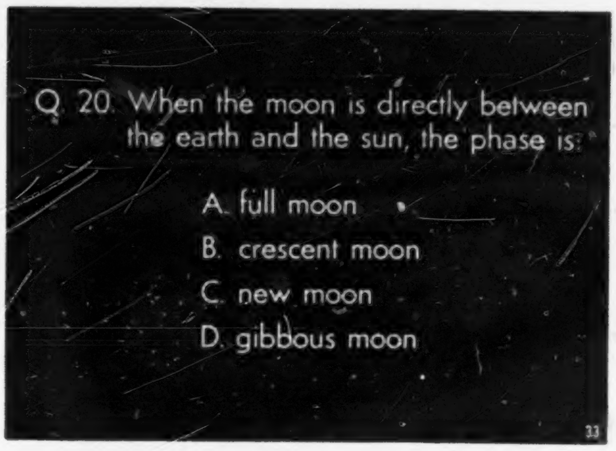
When the moon is between earth and sun, only the dark side faces us. The moon is invisible in the sunlight. It is NEW MOON.

POSITION OF
NEW MOON
SEPT. 1
SUN
EARTH
31



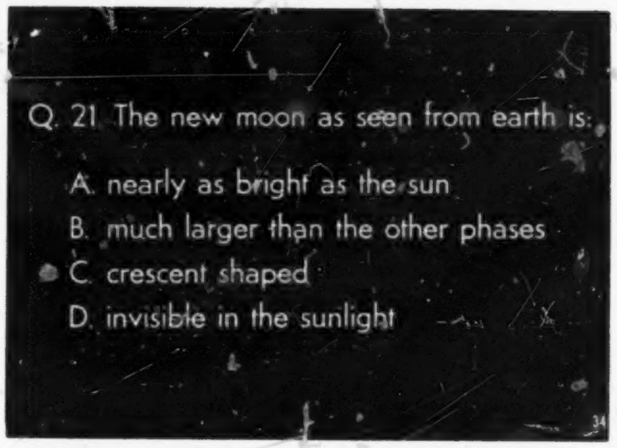
Q. 19. Which diagram represents the position of sun, moon, and earth during the new moon phase?

MOON
EARTH
SUN
A
EARTH
SUN
MOON
B
EARTH
MOON
SUN
C
EARTH
MOON
SUN
D
32



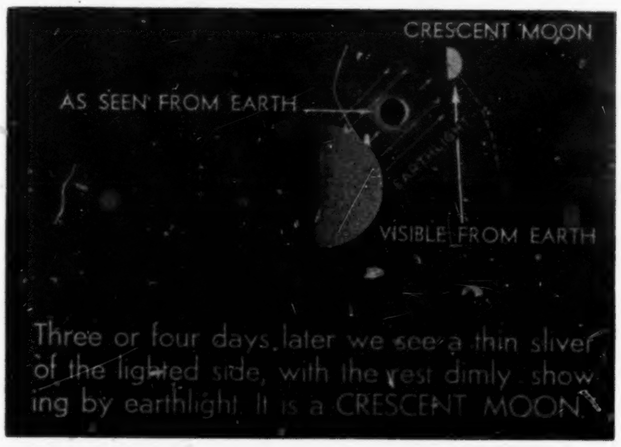
Q. 20. When the moon is directly between the earth and the sun, the phase is:

A. full moon
B. crescent moon
C. new moon
D. gibbous moon



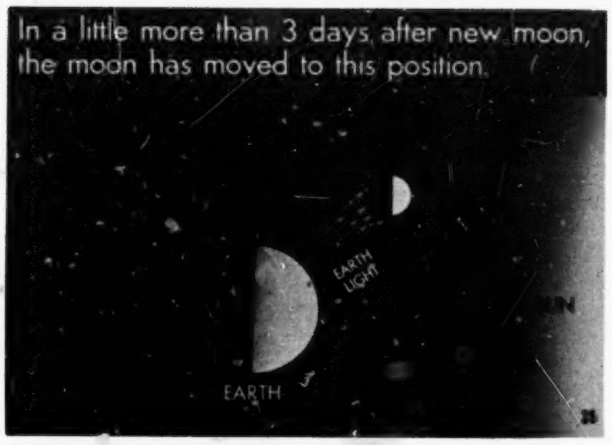
Q. 21. The new moon as seen from earth is:

A. nearly as bright as the sun
B. much larger than the other phases
C. crescent shaped
D. invisible in the sunlight



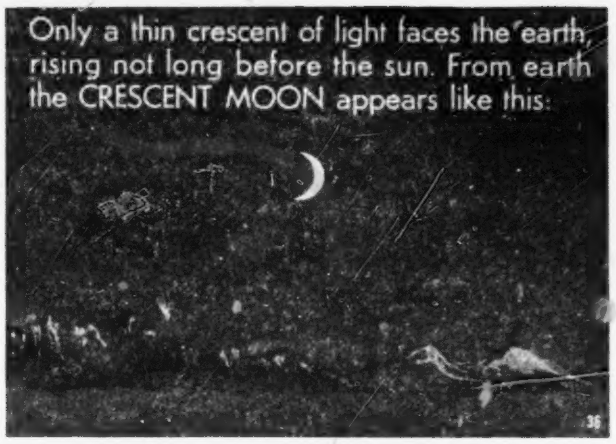
CRESCENT MOON
AS SEEN FROM EARTH
EARTHLIGHT
VISIBLE FROM EARTH

Three or four days later we see a thin sliver of the lighted side, with the rest dimly showing by earthlight. It is a CRESCENT MOON.

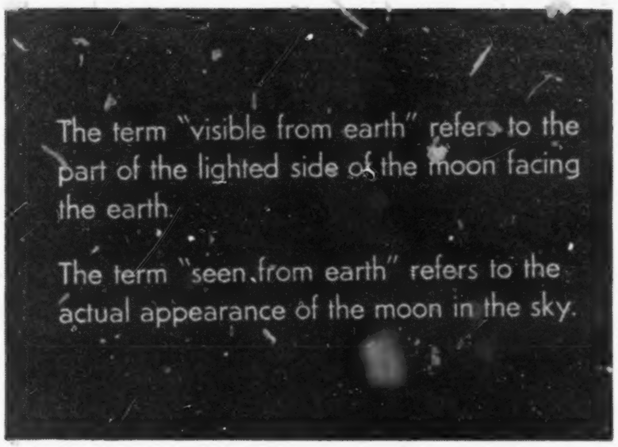


In a little more than 3 days after new moon, the moon has moved to this position.

EARTH LIGHT
SUN
EARTH

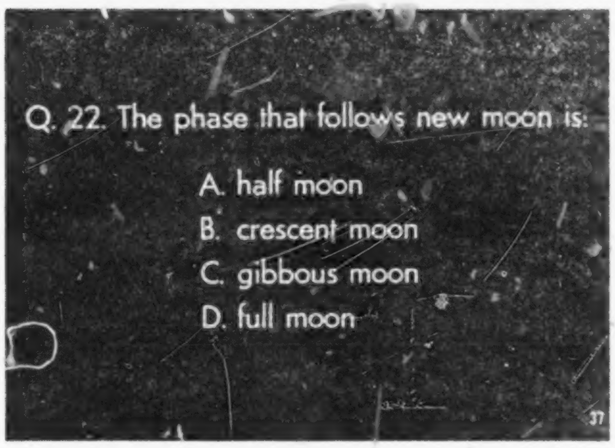


Only a thin crescent of light faces the earth, rising not long before the sun. From earth the CRESCENT MOON appears like this:



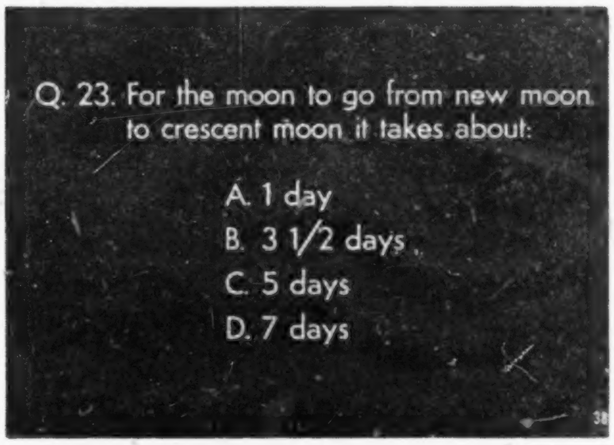
The term "visible from earth" refers to the part of the lighted side of the moon facing the earth.

The term "seen from earth" refers to the actual appearance of the moon in the sky.



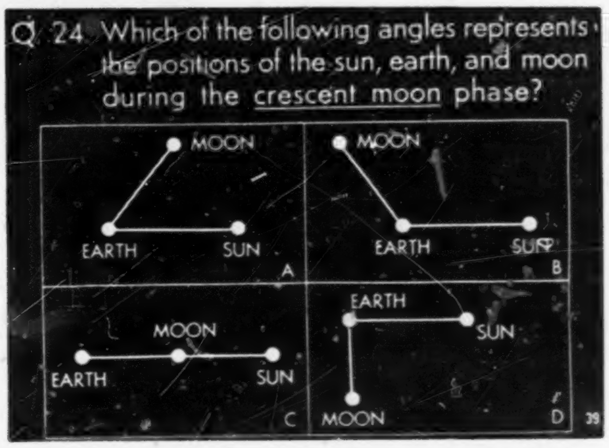
Q. 22. The phase that follows new moon is:

- A. half moon
- B. crescent moon
- C. gibbous moon
- D. full moon



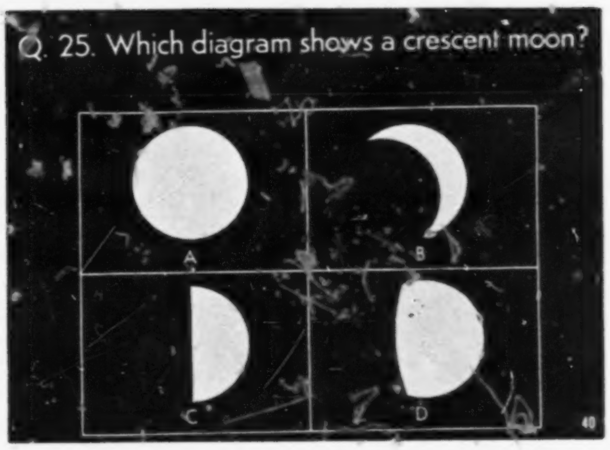
Q. 23. For the moon to go from new moon to crescent moon it takes about:

- A. 1 day
- B. 3 1/2 days
- C. 5 days
- D. 7 days

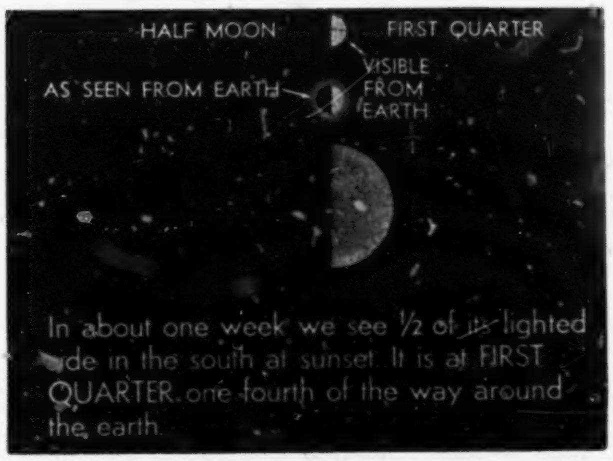


Q. 24. Which of the following angles represents the positions of the sun, earth, and moon during the crescent moon phase?

MOON
EARTH
SUN
A
MOON
EARTH
SUN
B
MOON
EARTH
SUN
C
EARTH
SUN
MOON
D
39

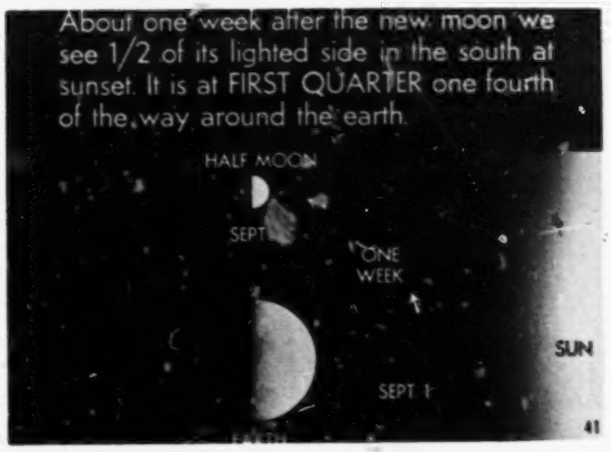


Q. 25. Which diagram shows a crescent moon?



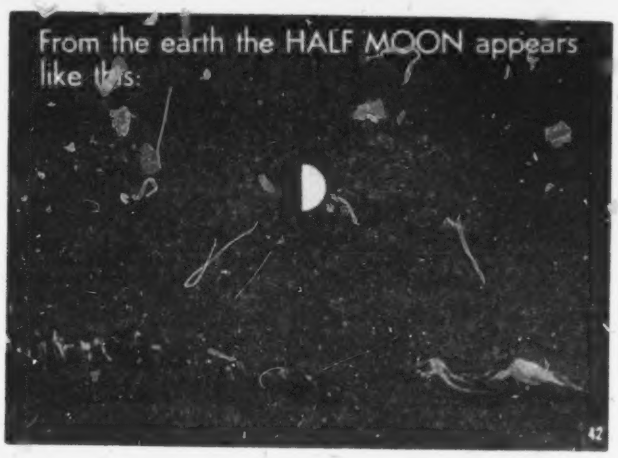
HALF MOON
FIRST QUARTER
AS SEEN FROM EARTH
VISIBLE
FROM
EARTH

In about one week we see ½ of its lighted side in the south at sunset. It is at FIRST QUARTER one fourth of the way around the earth.

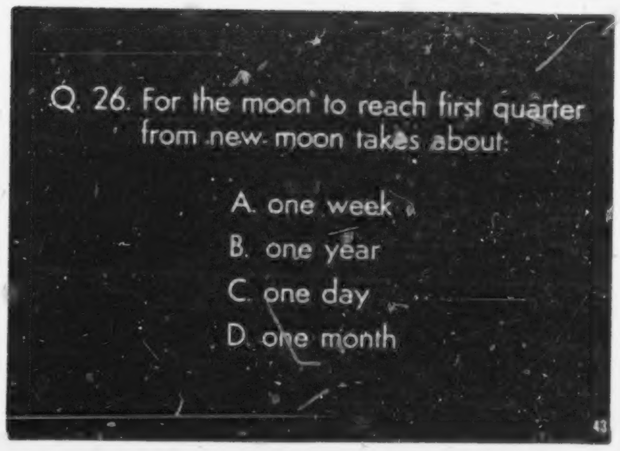


About one week after the new moon we see 1/2 of its lighted side in the south at sunset. It is at FIRST QUARTER one fourth of the way around the earth.

HALF MOON
SEPT
ONE
WEEK
SUN
SEPT 1
41

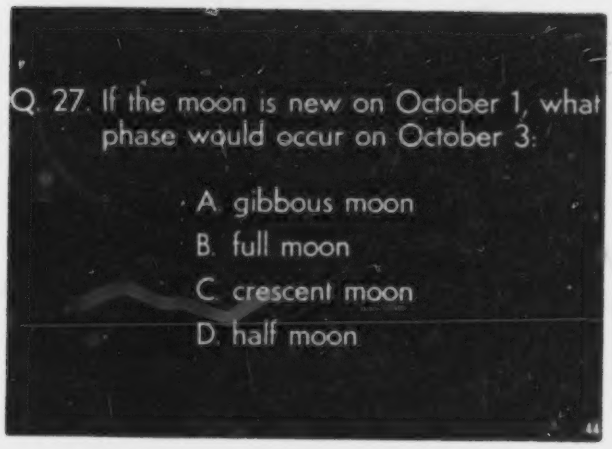


From the earth the HALF MOON appears like this:



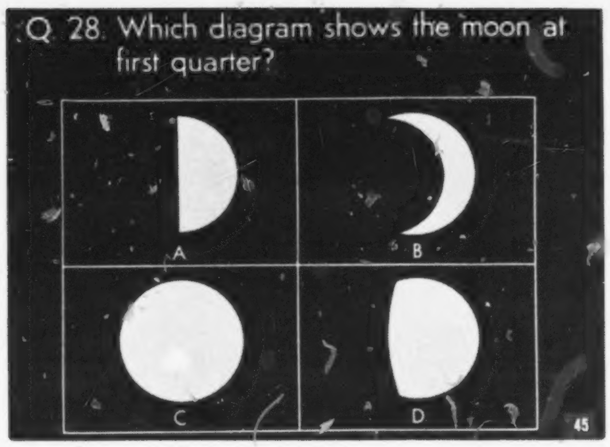
Q. 26. For the moon to reach first quarter from new moon takes about:

A. one week
B. one year
C. one day
D. one month

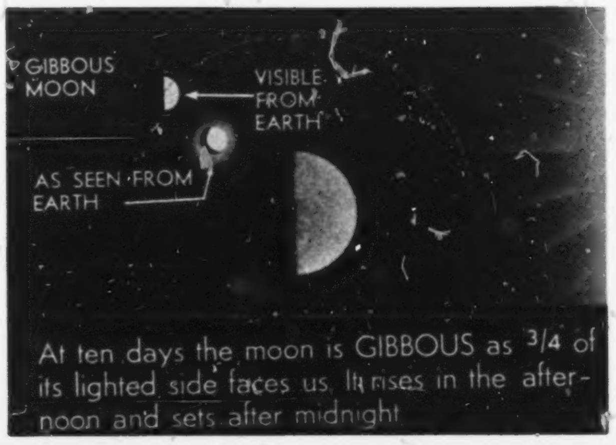


Q. 27. If the moon is new on October 1, what phase would occur on October 3:

A. gibbous moon
B. full moon
C. crescent moon
D. half moon

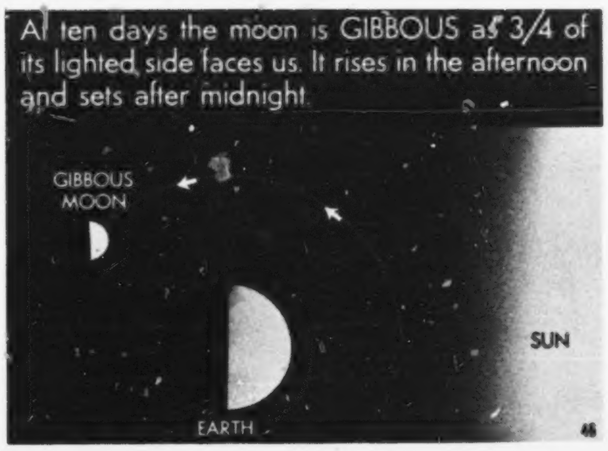


Q. 28. Which diagram shows the moon at first quarter?



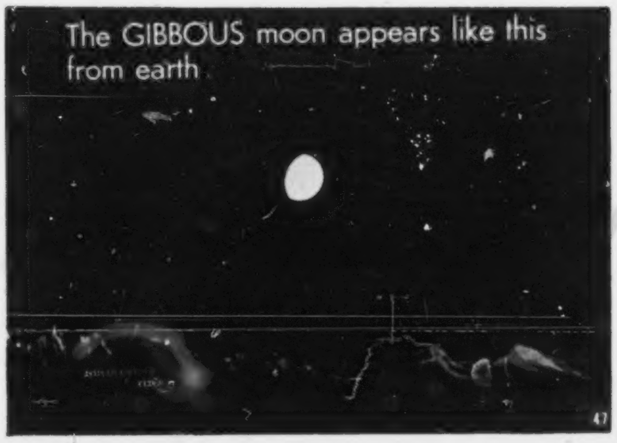
GIBBOUS MOON
VISIBLE FROM EARTH
AS SEEN FROM EARTH

At ten days the moon is GIBBOUS as 3/4 of its lighted side faces us. It rises in the afternoon and sets after midnight.

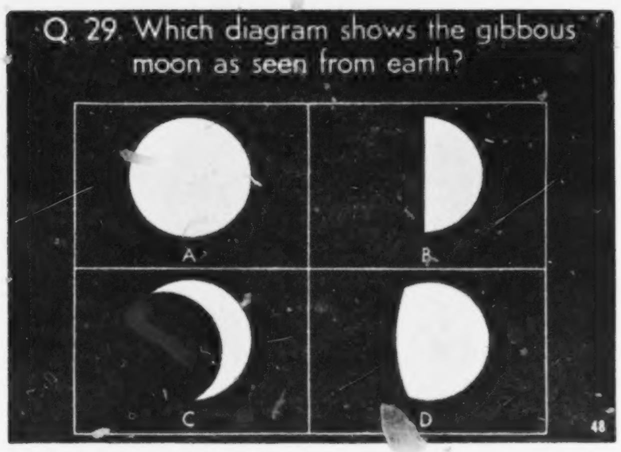


At ten days the moon is GIBBOUS as 3/4 of its lighted side faces us. It rises in the afternoon and sets after midnight.

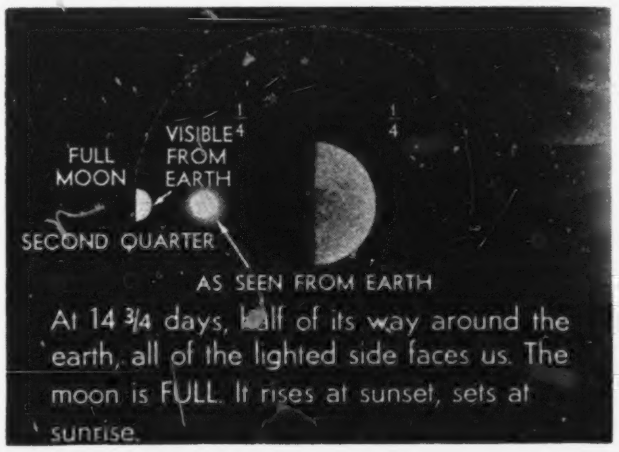
GIBBOUS MOON
SUN
EARTH
46



The GIBBOUS moon appears like this from earth

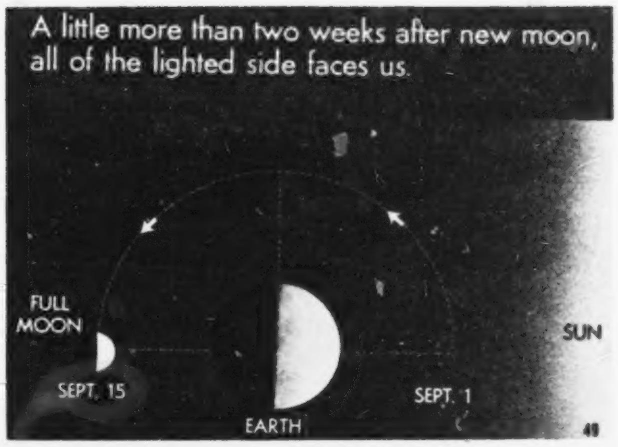


Q. 29. Which diagram shows the gibbous moon as seen from earth?



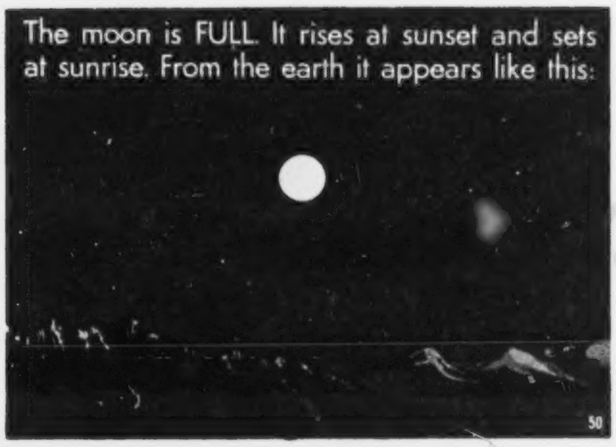
At 14 3/4 days, half of its way around the earth, all of the lighted side faces us. The moon is FULL. It rises at sunset, sets at sunrise.

1/4
1/4
VISIBLE FROM EARTH
FULL MOON
SECOND QUARTER
AS SEEN FROM EARTH

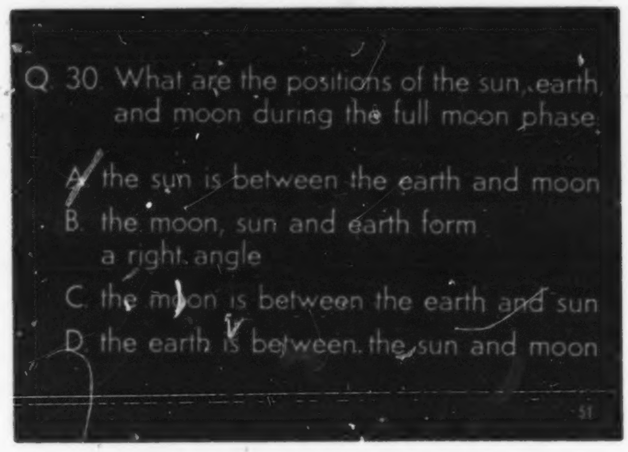


A little more than two weeks after new moon, all of the lighted side faces us.

FULL MOON
SUN
SEPT. 15
SEPT. 1
EARTH
49



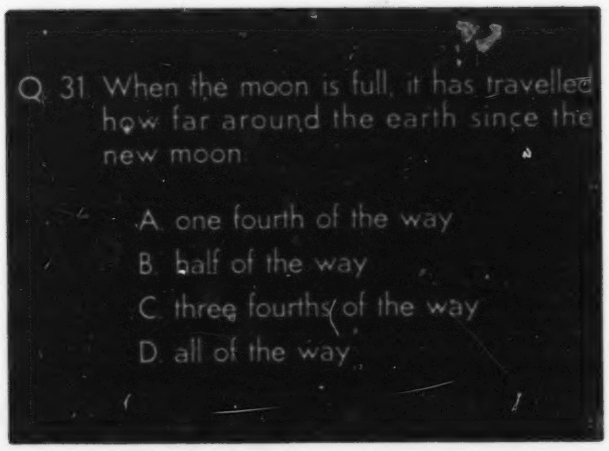
The moon is FULL. It rises at sunset and sets at sunrise. From the earth it appears like this:



Q 30. What are the positions of the sun, earth, and moon during the full moon phase.

A. the sun is between the earth and moon
B. the moon, sun and earth form a right angle
C. the moon is between the earth and sun
D. the earth is between the sun and moon

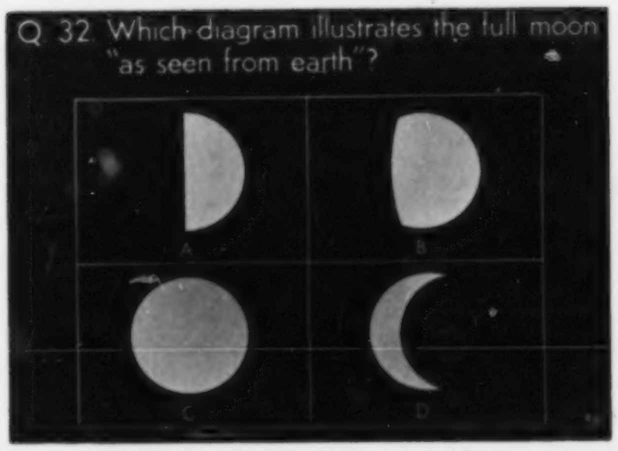
51

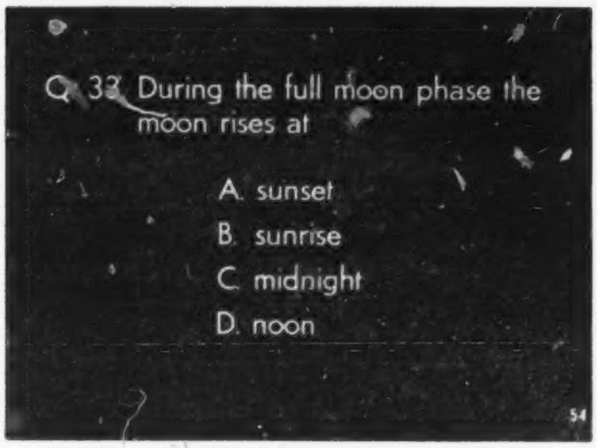


Q 31. When the moon is full, it has travelled how far around the earth since the new moon

A. one fourth of the way
B. half of the way
C. three fourths of the way
D. all of the way

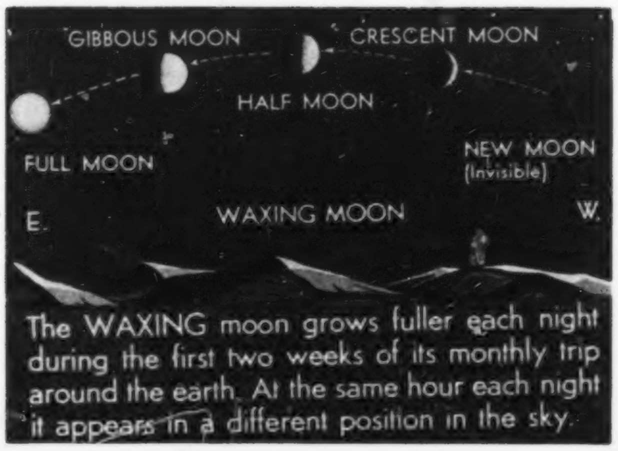
Q 32. Which diagram illustrates the full moon "as seen from earth"?



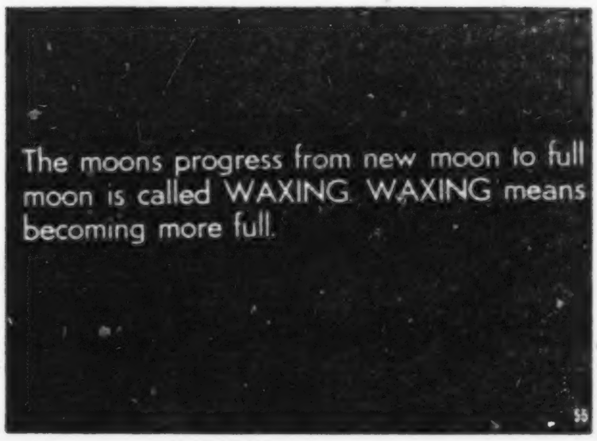


Q. 33. During the full moon phase the moon rises at

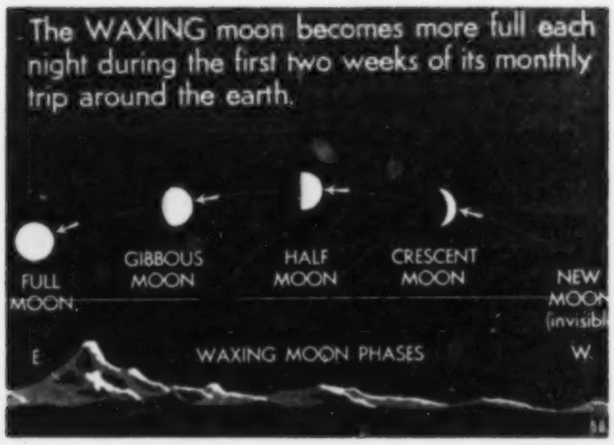
A. sunset
B. sunrise
C. midnight
D. noon


GIBBOUS MOON
CRESCENT MOON
HALF MOON
FULL MOON
NEW MOON (Invisible)
E.
WAXING MOON
W.

The WAXING moon grows fuller each night during the first two weeks of its monthly trip around the earth. At the same hour each night it appears in a different position in the sky.

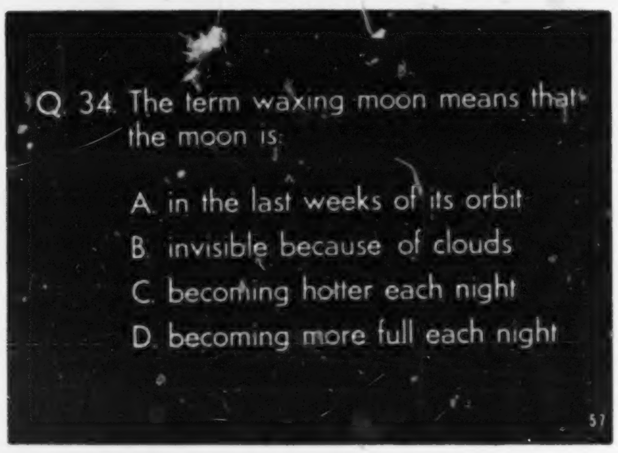


The moons progress from new moon to full moon is called WAXING. WAXING means becoming more full.



The WAXING moon becomes more full each night during the first two weeks of its monthly trip around the earth.

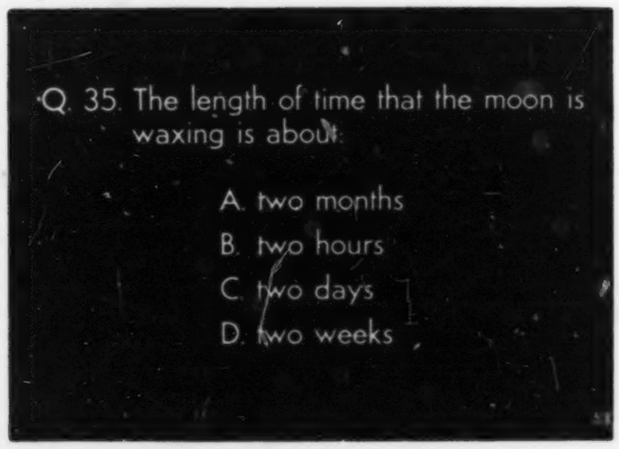
FULL MOON
GIBBOUS MOON
HALF MOON
CRESCENT MOON
NEW MOO (invisib
E
WAXING MOON PHASES
W.



Q. 34. The term waxing moon means that the moon is:

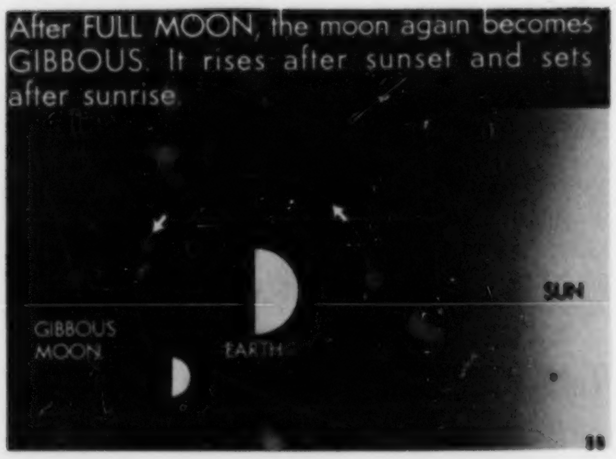
A. in the last weeks of its orbit
B. invisible because of clouds
C. becoming hotter each night
D. becoming more full each night

57

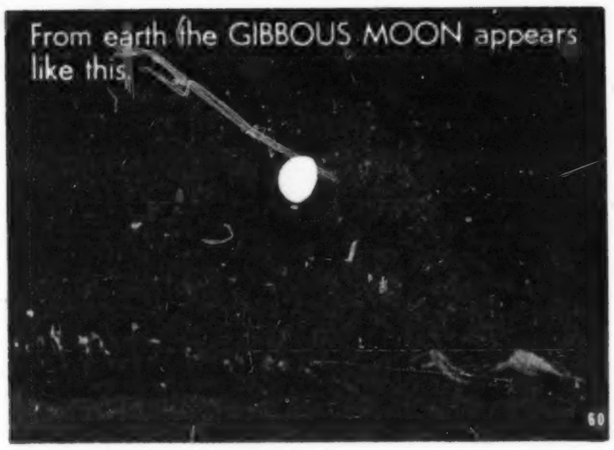


Q. 35. The length of time that the moon is waxing is about:

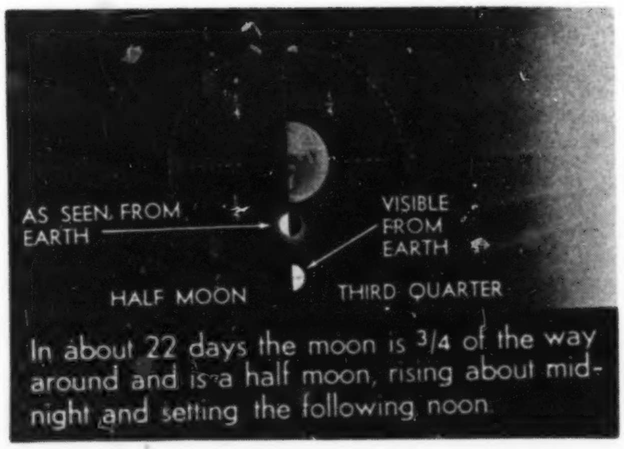
A. two months
B. two hours
C. two days
D. two weeks



After FULL MOON, the moon again becomes GIBBOUS. It rises after sunset and sets after sunrise.



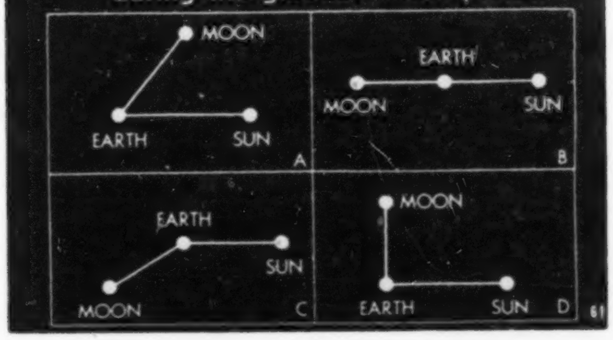
From earth the GIBBOUS MOON appears like this.



AS SEEN FROM EARTH
VISIBLE FROM EARTH
HALF MOON
THIRD QUARTER

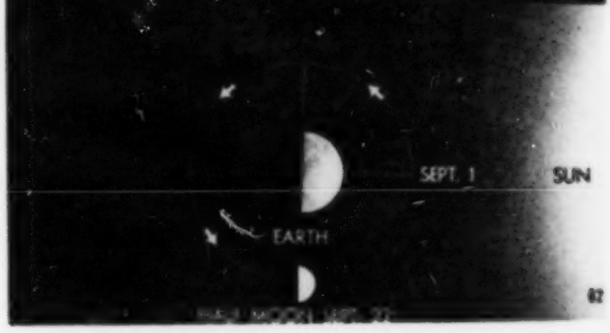
In about 22 days the moon is $3/4$ of the way around and is a half moon, rising about midnight and setting the following noon.

Q. 36. Which of the following angles represents the positions of the sun, earth, and moon during the gibbous moon phase?

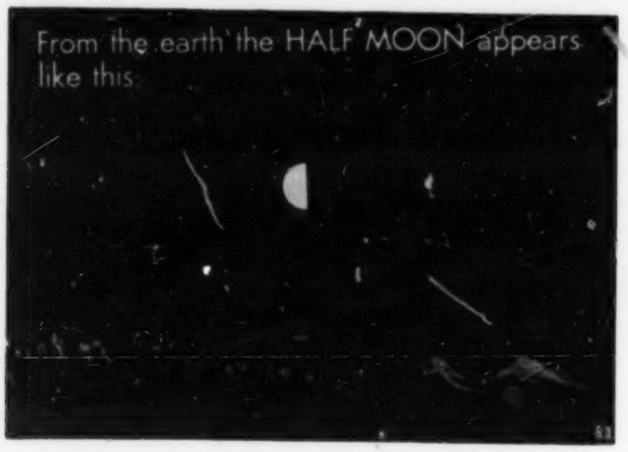


MOON
EARTH
SUN
A
EARTH
MOON
SUN
B
EARTH
SUN
MOON
C
MOON
EARTH
SUN
D
61

In about 22 days the moon is $\frac{3}{4}$ of the way around and is a half moon, rising about midnight and setting the following noon.

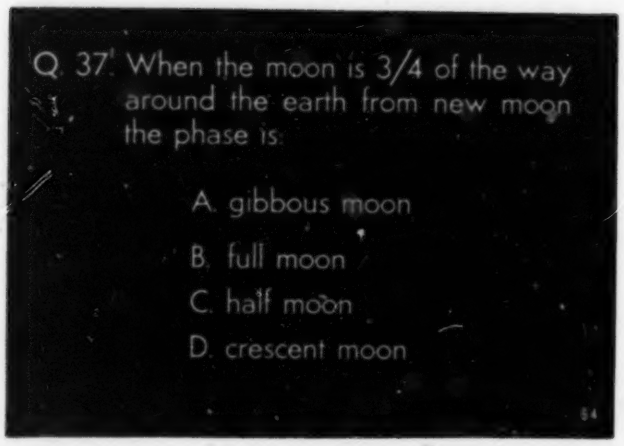


SEPT. 1
SUN
EARTH
HALF MOON SEPT. 22
62



From the earth the HALF MOON appears like this.

63



Q. 37. When the moon is 3/4 of the way around the earth from new moon the phase is:

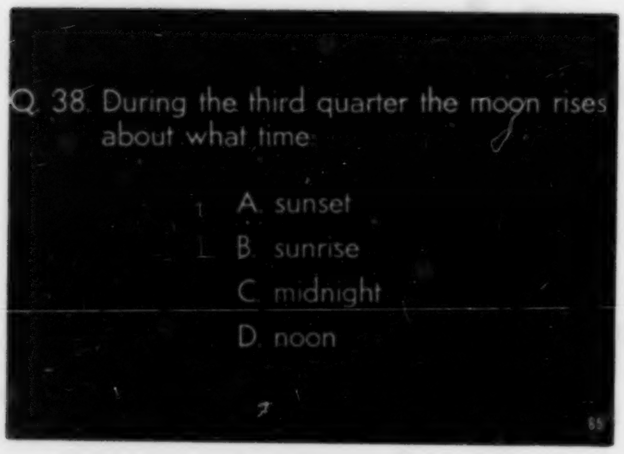
A. gibbous moon

B. full moon

C. half moon

D. crescent moon

64



Q. 38. During the third quarter the moon rises about what time:

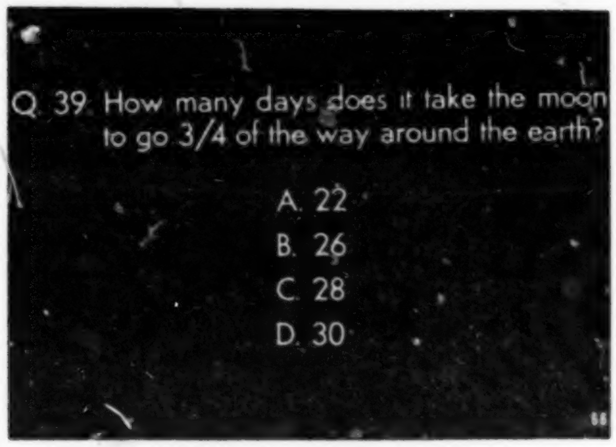
A. sunset

B. sunrise

C. midnight

D. noon

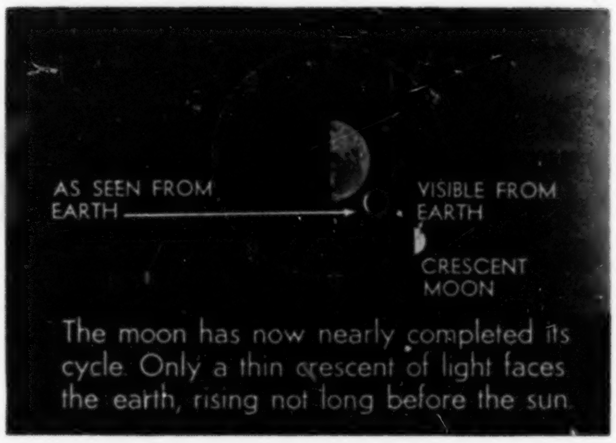
65



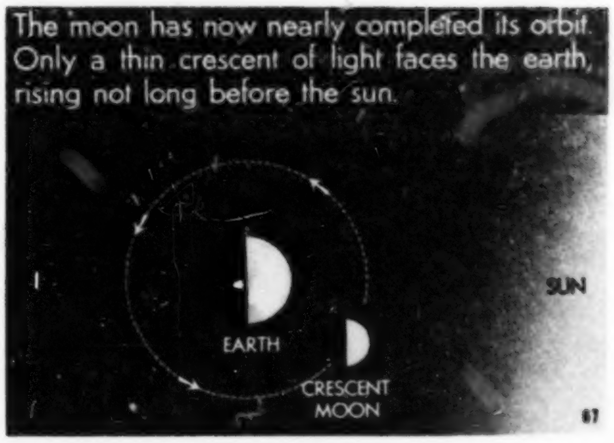
Q. 39. How many days does it take the moon to go 3/4 of the way around the earth?

A. 22
B. 26
C. 28
D. 30

66


AS SEEN FROM EARTH
VISIBLE FROM EARTH
CRESCENT MOON

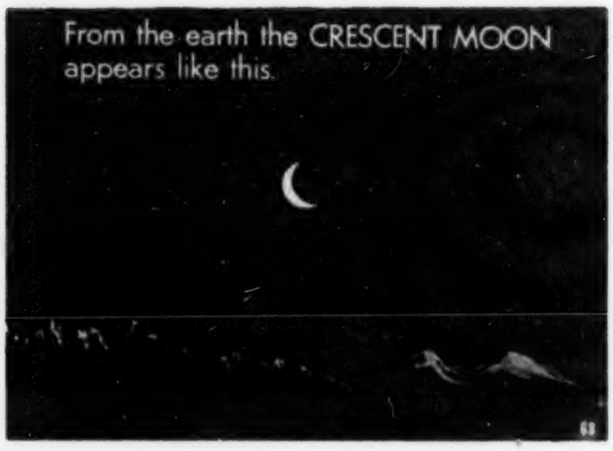
The moon has now nearly completed its cycle. Only a thin crescent of light faces the earth, rising not long before the sun.



The moon has now nearly completed its orbit. Only a thin crescent of light faces the earth, rising not long before the sun.

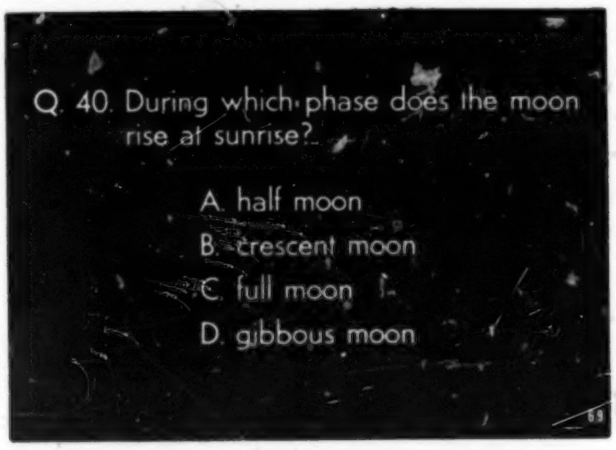
EARTH
CRESCENT MOON
SUN

67



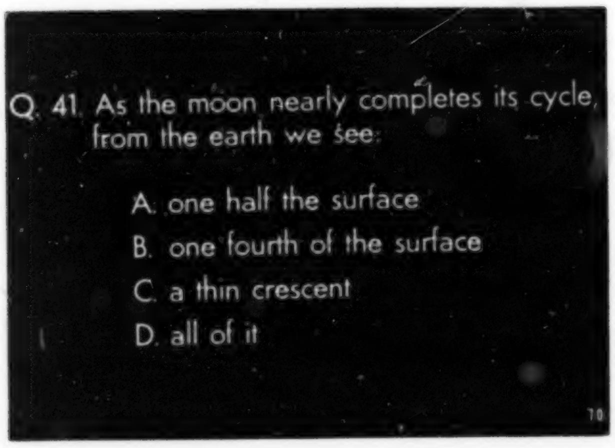
From the earth the CRESCENT MOON appears like this.

68



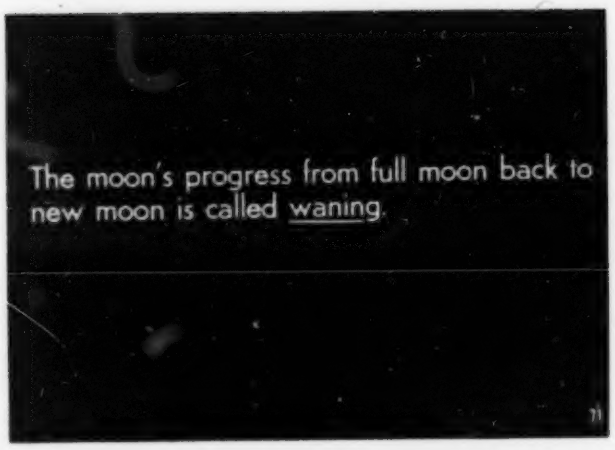
Q. 40. During which phase does the moon rise at sunrise?

A. half moon
B. crescent moon
C. full moon
D. gibbous moon

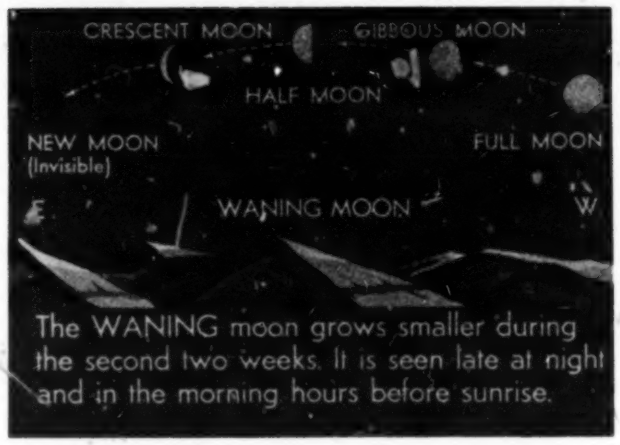


Q. 41. As the moon nearly completes its cycle, from the earth we see:

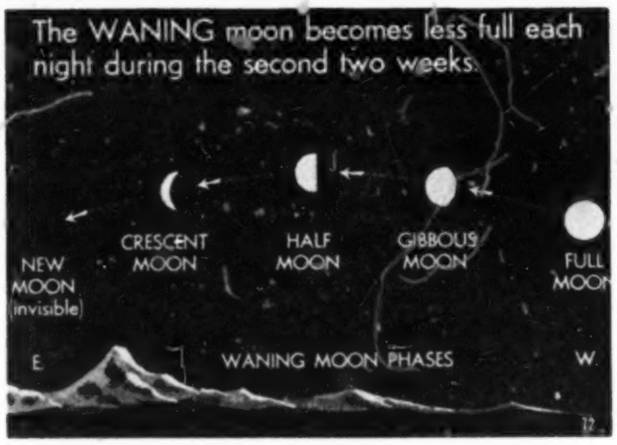
A. one half the surface
B. one fourth of the surface
C. a thin crescent
D. all of it



The moon's progress from full moon back to new moon is called waning.

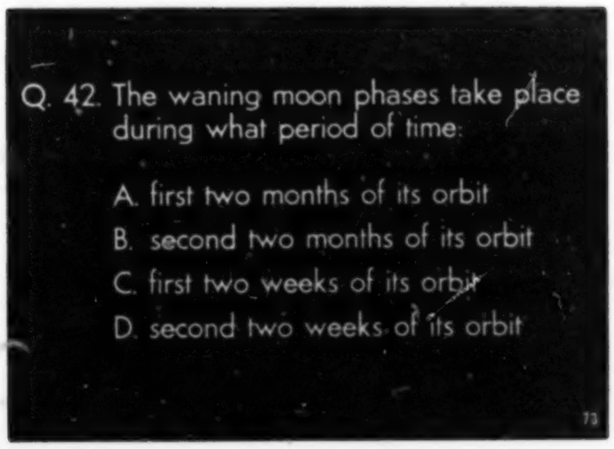

CRESCENT MOON
GIBBOUS MOON
HALF MOON
NEW MOON
(Invisible)
FULL MOON
E
WANING MOON
W

The WANING moon grows smaller during the second two weeks. It is seen late at night and in the morning hours before sunrise.



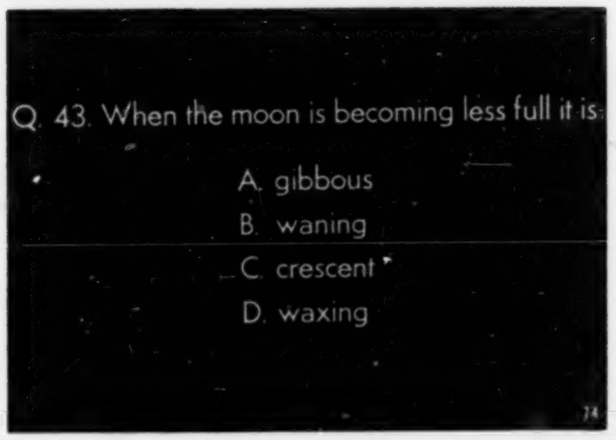
The WANING moon becomes less full each night during the second two weeks.

CRESCENT MOON
HALF MOON
GIBBOUS MOON
NEW MOON
(invisible)
FULL MOON
E
WANING MOON PHASES
W.
72



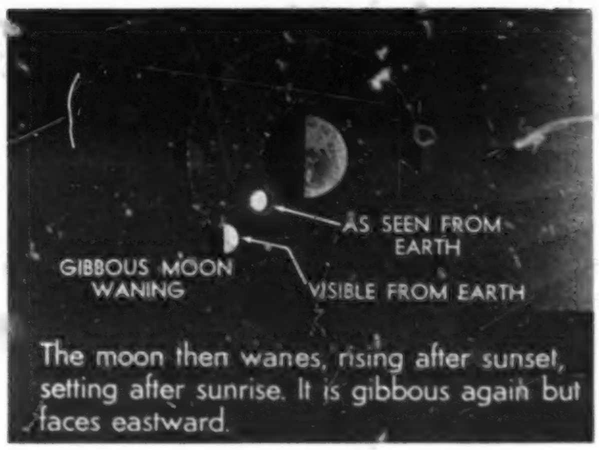
Q. 42. The waning moon phases take place during what period of time:

A. first two months of its orbit
B. second two months of its orbit
C. first two weeks of its orbit
D. second two weeks of its orbit

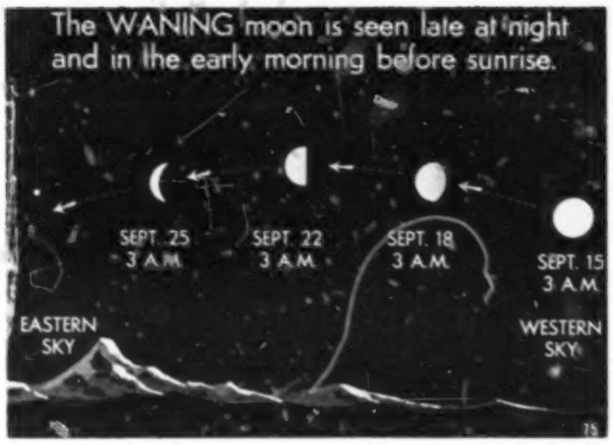


Q. 43. When the moon is becoming less full it is:

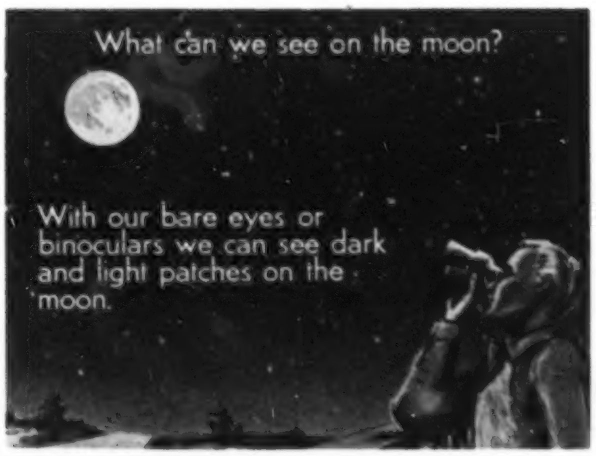
A. gibbous
B. waning
C. crescent
D. waxing


AS SEEN FROM EARTH
GIBBOUS MOON WANING
VISIBLE FROM EARTH

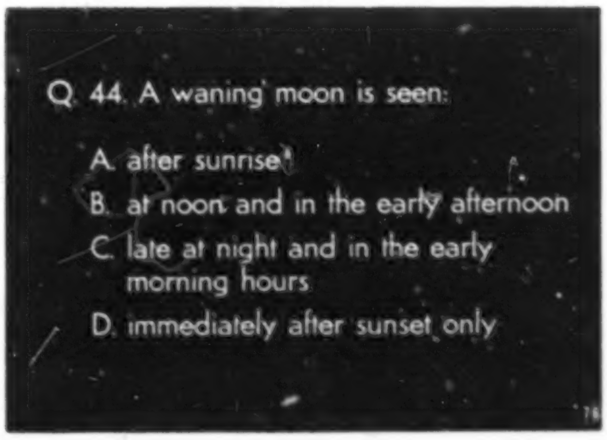
The moon then wanes, rising after sunset, setting after sunrise. It is gibbous again but faces eastward.


The WANING moon is seen late at night and in the early morning before sunrise.

SEPT. 25
3 A.M.
SEPT. 22
3 A.M.
SEPT. 18
3 A.M.
SEPT. 15
3 A.M.
EASTERN
SKY
WESTERN
SKY
75

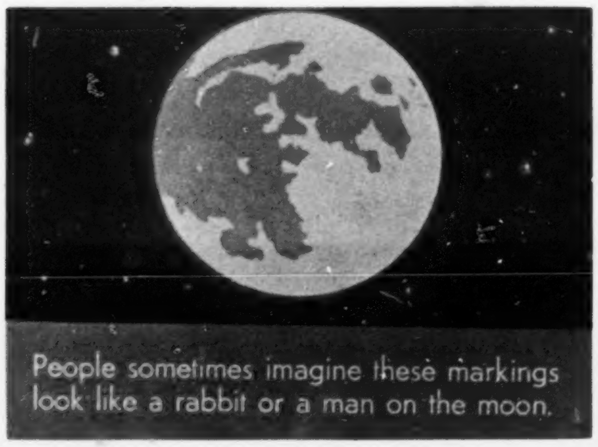

What can we see on the moon?

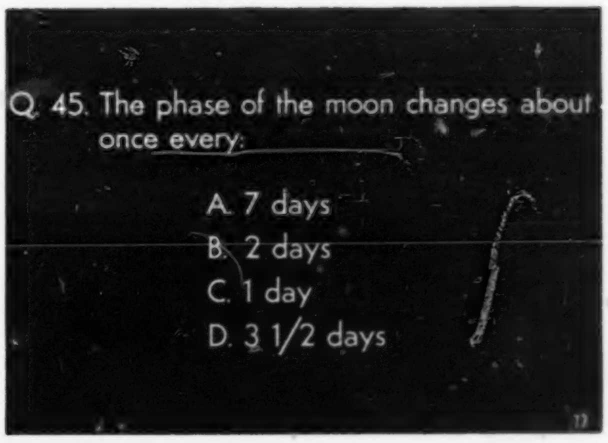
With our bare eyes or binoculars we can see dark and light patches on the moon.


Q. 44. A waning moon is seen:

A. after sunrise
B. at noon and in the early afternoon
C. late at night and in the early morning hours
D. immediately after sunset only

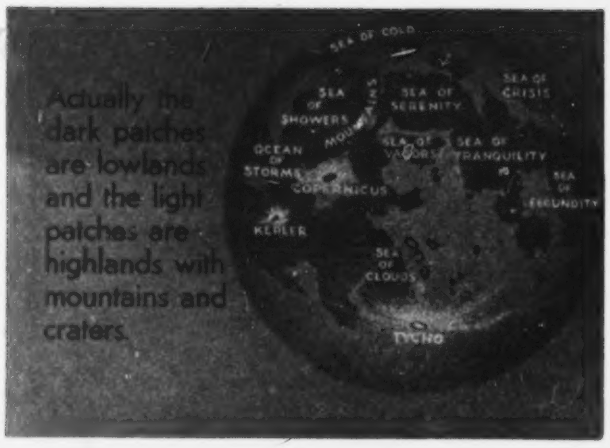
76


People sometimes imagine these markings look like a rabbit or a man on the moon.


Q. 45. The phase of the moon changes about once every:

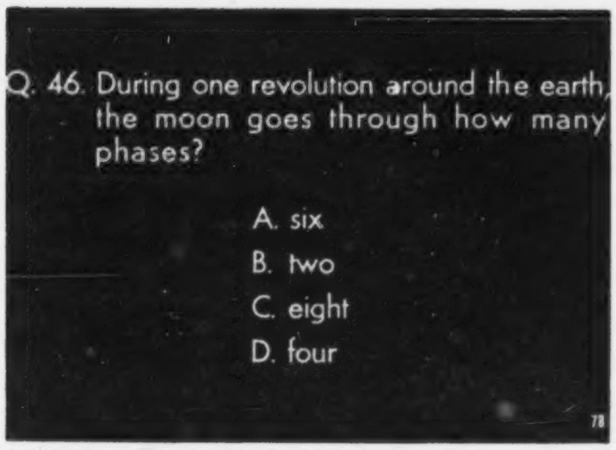
A. 7 days
B. 2 days
C. 1 day
D. 3 1/2 days

77



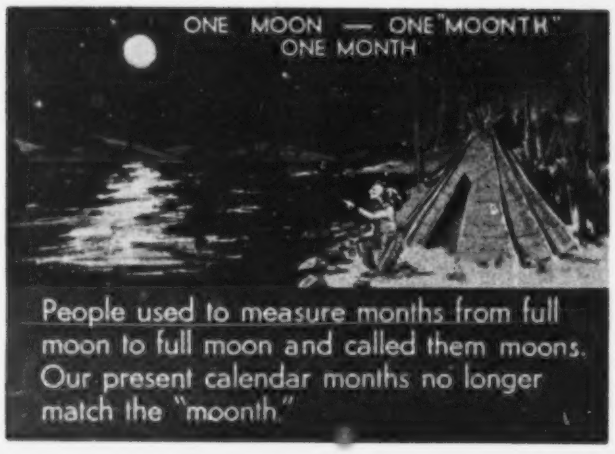
Actually the dark patches are lowlands and the light patches are highlands with mountains and craters.

SEA OF COLD
SEA OF SHOWERS
SEA OF SERENITY
SEA OF CRISIS
OCEAN OF STORMS
SEA OF VAPORS
SEA OF TRANQUILITY
SEA OF FECUNDITY
COPERNICUS
KEPLER
SEA OF CLOUDS
TYCHO



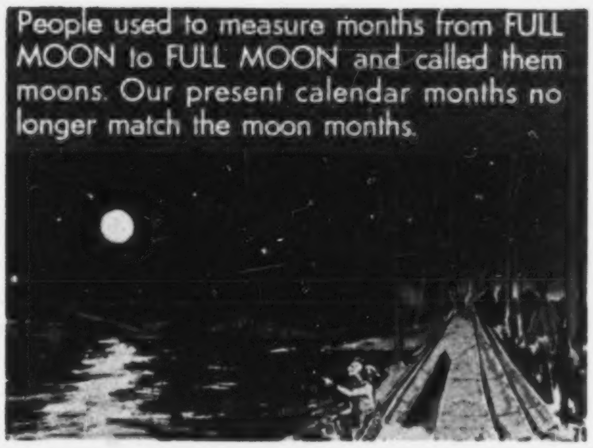
Q. 46. During one revolution around the earth, the moon goes through how many phases?

A. six
B. two
C. eight
D. four

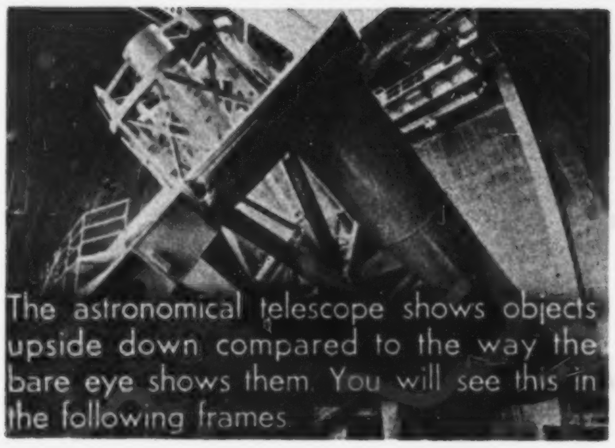


ONE MOON — ONE "MOONTH"
ONE MONTH

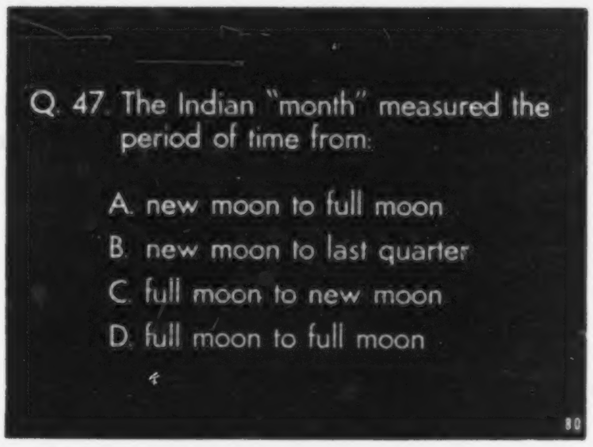
People used to measure months from full moon to full moon and called them moons. Our present calendar months no longer match the "moonth."



People used to measure months from FULL MOON to FULL MOON and called them moons. Our present calendar months no longer match the moon months.

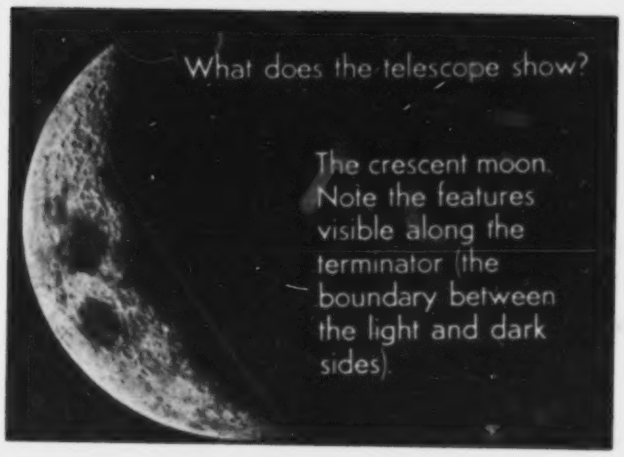


The astronomical telescope shows objects upside down compared to the way the bare eye shows them. You will see this in the following frames.



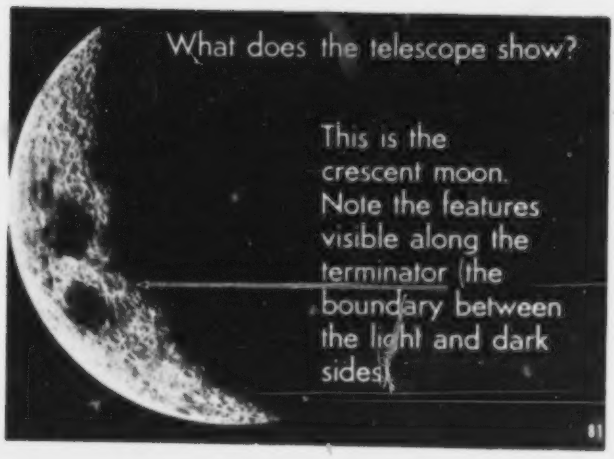
Q. 47. The Indian "month" measured the period of time from:

A. new moon to full moon
B. new moon to last quarter
C. full moon to new moon
D. full moon to full moon



What does the telescope show?

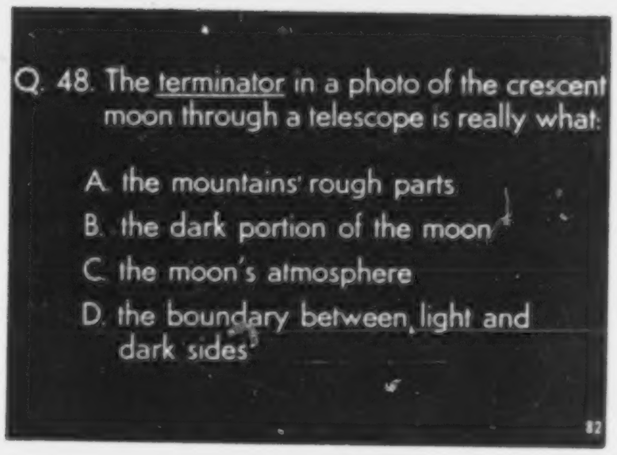
The crescent moon. Note the features visible along the terminator (the boundary between the light and dark sides).



What does the telescope show?

This is the crescent moon. Note the features visible along the terminator (the boundary between the light and dark sides).

81



Q. 48. The terminator in a photo of the crescent moon through a telescope is really what:

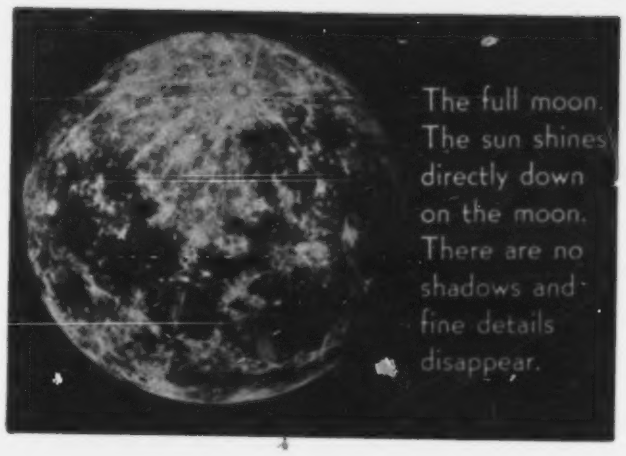
A. the mountains rough parts

B. the dark portion of the moon

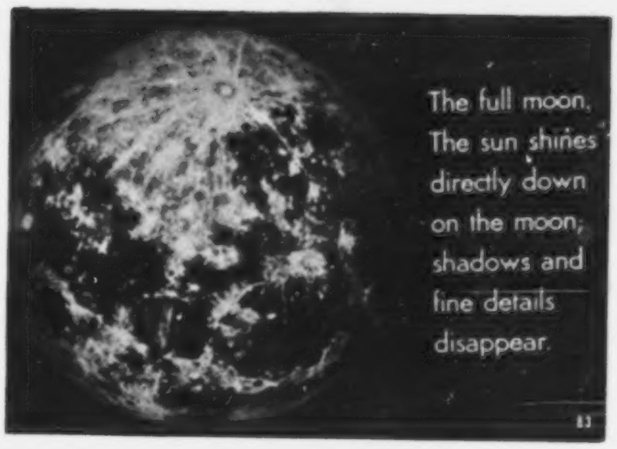
C. the moon's atmosphere

D. the boundary between light and dark sides

82

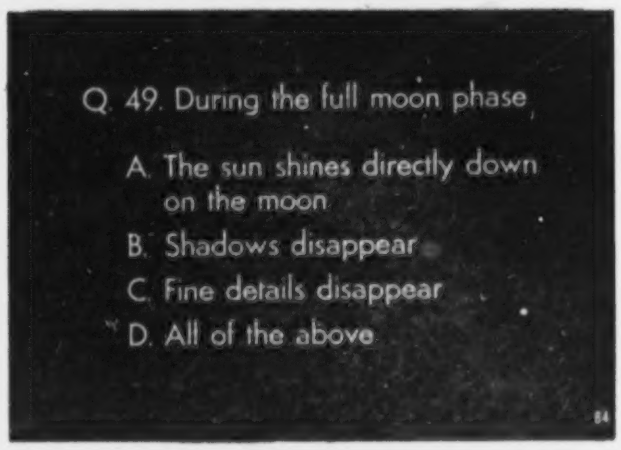


The full moon. The sun shines directly down on the moon. There are no shadows and fine details disappear.



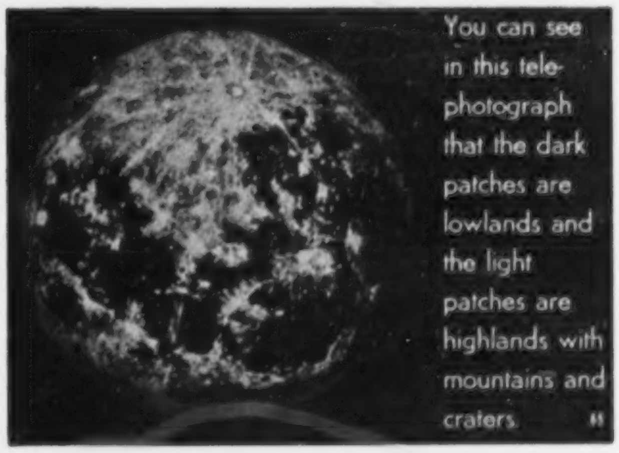
The full moon. The sun shines directly down on the moon; shadows and fine details disappear.

83

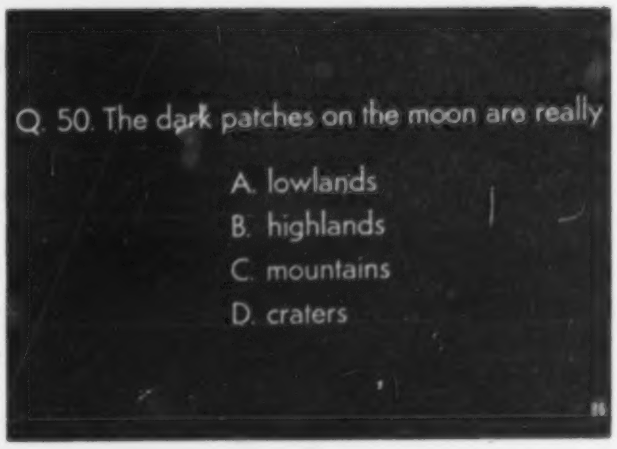


Q. 49. During the full moon phase

A. The sun shines directly down on the moon
B. Shadows disappear
C. Fine details disappear
D. All of the above

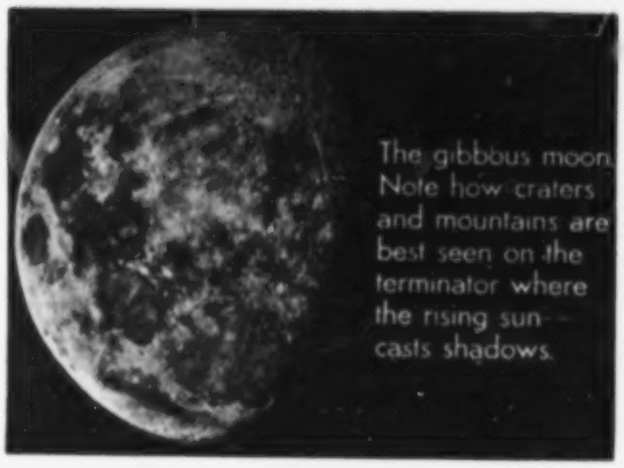


You can see in this telephotograph that the dark patches are lowlands and the light patches are highlands with mountains and craters.

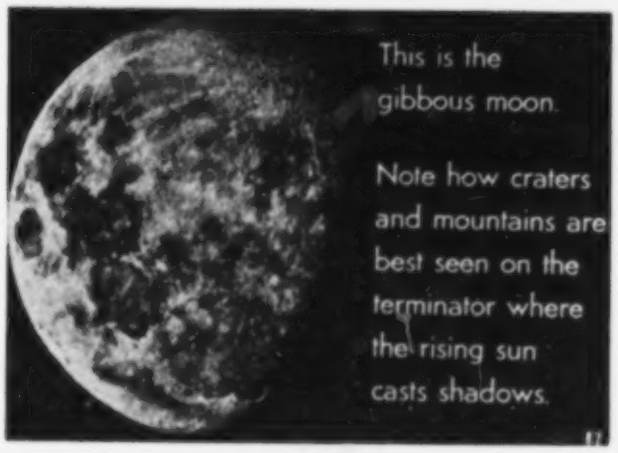


Q. 50. The dark patches on the moon are really

A. lowlands
B. highlands
C. mountains
D. craters

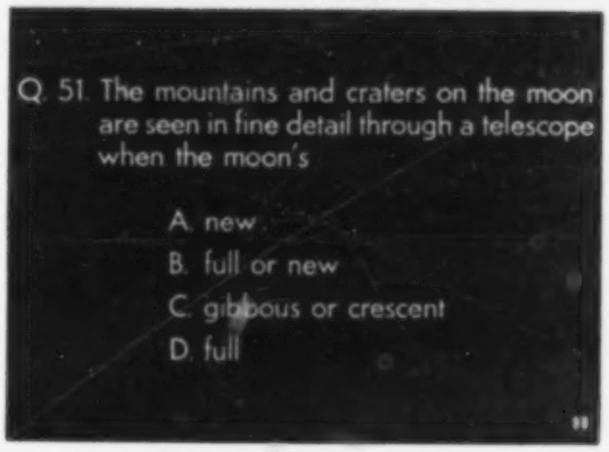


The gibbous moon. Note how craters and mountains are best seen on the terminator where the rising sun casts shadows.



This is the gibbous moon.

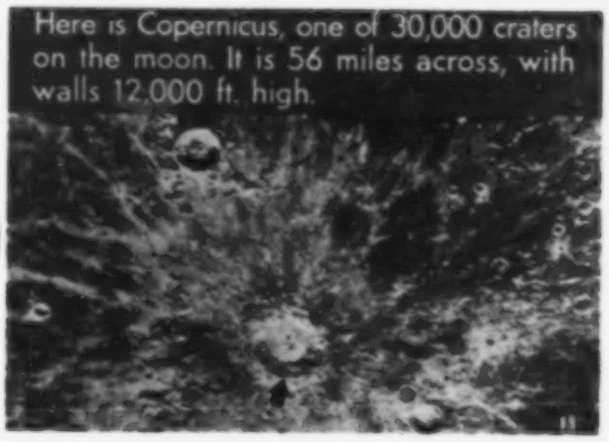
Note how craters and mountains are best seen on the terminator where the rising sun casts shadows.



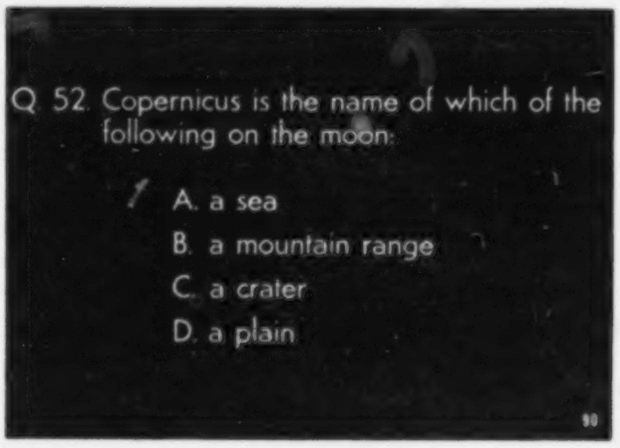
Q. 51. The mountains and craters on the moon are seen in fine detail through a telescope when the moon's

A. new
B. full or new
C. gibbous or crescent
D. full

Here is Copernicus, one of 30,000 craters on the moon. It is 56 miles across, with walls 12,000 ft. high.



Here is Copernicus, one of 30,000 craters on the moon. It is 56 miles across, with walls 12,000 ft. high.



Q. 52. Copernicus is the name of which of the following on the moon:

A. a sea

B. a mountain range

C. a crater

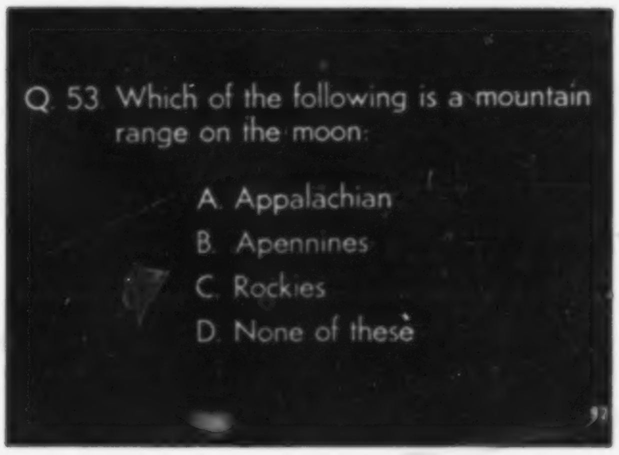
D. a plain

90

There are many jagged mountain ranges on the moon. Here we see the Apennines some of which rise 20,000 ft. above the plains.

There are many jagged mountain ranges on the moon. Here we see the Apennines, some of which rise 20,000 ft. above the plains.

91



Q. 53. Which of the following is a mountain range on the moon:

A. Appalachian

B. Apennines

C. Rockies

D. None of these

92

## APPENDIX B

### Instructions and Practice Questions for Using the Rapid-Raters with Confirmation

On the desk in front of you is a device called a Rapid-Rater.
In the lower right hand edge of the Rapid-Rater is a small metal stylus.
Remove the stylus from the Rapid-Rater and lay it on the desk.
The Rapid-Rater and the stylus are used for answering questions.
The Rapid-Rater has many rows of holes in it.
Each row of holes is numbered.
Row 1 will be used to answer question 1.
Row 2 will be used to answer question 2.
Each hole in each row has a letter above it.
The holes in each row are lettered A, B, C, and D.
The letters A, B, C, and D match the answers you may choose from for each question.
Use the stylus and punch it into each of the four holes after question 1.
Notice that the stylus made a larger hole for answer C than for the other answers.
The larger hole means that C was the correct answer for question 1.
Now read question 2 below and punch the answer you think is correct.

Question 2: Our school is located in the state of:
A. New York C. New Jersey
B. Ohio D. Pennsylvania

If your stylus made a small hole your answer was not correct.
Reread the question and try again until you answer correctly.
If your stylus made a large hole your answer was correct.
Continue with the following questions in the same way.

Q 3: 5 X 25 = _____
A. 50 C. 125
B. 75 D. 150

Q 4: When we change from Eastern Standard Time to Eastern Daylight Saving Time we move our clocks:
A. back one hour C. back two hours
B. ahead one hour D. ahead two hours

Q 5: The capital of Pennsylvania is:
A. Pittsburgh C. Erie
B. Philadelphia D. Harrisburg

Remember: a large hole means a correct answer.
Remember: a small hole means a wrong answer.

STOP AND WAIT FOR FURTHER INSTRUCTIONS

# APPENDIX C

## Instructions and Practice Questions for Using the Rapid-Raters with No Confirmation

On the desk in front of you is a device called a Rapid-Rater.

In the lower right hand edge of the Rapid-Rater is a small metal stylus.

Remove the stylus from the Rapid-Rater and lay it on the desk.

The Rapid-Rater and the stylus are used for answering questions.

The Rapid-Rater has many rows of holes in it.

Each row of holes is numbered.

Row 1 will be used to answer question 1.

Row 2 will be used to answer question 2.

Each hole in each row has a letter above it.

The holes in each row are lettered A, B, C, and D.

The letters A, B. C, and D match the answers you may choose from for each question.

Use the stylus and punch it into each of the four holes after question 1.

Now read question 2 and punch the answer you think is correct.

Punch only one answer for each question.

Question 2: Our school is located in the state of:
A. New York C. New Jersey
B. Ohio D. Pennsylvania

Q 3: 5 X 25 = ______
A. 50 C. 125
B. 75 D. 150

Q 4: When we change from Eastern Standard Time to Eastern Daylight Saving Time we move our clocks:
A. back one hour C. back two hours
B. ahead one hour D. ahead two hours

Q 5: The capital of Pennsylvania is:
A. Pittsburgh C. Erie
B. Philadelphia D. Harrisburg

STOP AND WAIT FOR FURTHER INSTRUCTIONS

## APPENDIX D

### Pretest
(*indicates the accepted response)

1. A satellite can be best described by the term:
   1. planet
   *2. moon
   3. star
   4. sun

2. The apparent size of the moon on the horizon is explained by:
   1. optical
   2. nearsightedness
   3. farsightedness
   *4. optical illusion

3. Dark patches on the moon are really
   1. highlands
   *2. lowlands
   3. mountains
   4. craters

4. The moon shines mainly because:
   1. it is on fire
   *2. it reflects sunlight
   3. it is made of glowing matter
   4. it has radium in its composition

5. Sometimes the darker part of the moon can be seen by:
   1. glowing ashes
   2. forest fires on it
   *3. reflected earthlight
   4. burning gases

6. Satellites follow what direction around a planet:
   1. same direction as the hands of a clock
   2. always upward toward the sun
   *3. opposite the direction of the hands of a clock
   4. always downward away from the sun

7. The earth's nearest neighbor is the:
   *1. moon
   2. sun
   3. North star
   4. Mercury

8. When it is rising or setting, the moon seems:
   1. smaller than when it is high in the sky
   *2. larger than when it is high in the sky
   3. the same size as when it is high in the sky
   4. sometimes larger and sometimes smaller than when it is high in the sky

9. What can we see on the moon with our bare eyes or binoculars:
   *1. light and dark patches
   2. people and animals
   3. lakes and streams
   4. rivers and oceans

10. The diameter of the moon compared with the earth is:
   1. 2 times larger
   *2. 1/4 as large
   3. 1/2 as large
   4. 4 times larger

# APPENDIX E

## Posttest

(*indicates the accepted response)

1. The term waning moon means that the moon is
    1. in the first weeks of its orbit
    2. invisible because of clouds
    3. becoming hotter each night
    *4. becoming less full each night
    5. becoming more full each night

2. When the moon is becoming more full each night, we say it is
    1. perigee
    2. apogee
    3. phasing
    4. waning
    *5. waxing

3. How far has the moon travelled around the earth in 22 days?
    1. 1/4
    2. 1/3
    3. 1/2
    4. 2/3
    *5. 3/4

4. The phase that follows half moon is:
    1. new moon
    2. crescent moon
    *3. crescent moon or gibbous moon
    4. gibbous moon
    5. full moon

5. The terminator in a photo of the crescent moon is really
    1. the mountains rough parts
    2. the dark portion of the moon
    3. the moon's atmosphere
    *4. the boundary between light and dark sides of the moon

6. How much of the moon's surface is lighted at one time?
    1. all
    2. one half
    *3. one fourth
    4. depends on the phase

7. If the moon is new on August 1 it will become crescent on
    1. August 2
    *2. August 3
    3. August 5
    4. August 7
    5. August 10

8. How far from new moon has the moon travelled around the earth when it is half moon?
   *1. 1/4
   2. 1/2
   3. 3/4
   4. 1/4 and 3/4
   5. 1/4 and 1/2

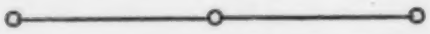
9. When the moon has travelled half way around the earth since the new moon it is
   1. crescent moon
   2. half moon
   3. gibbous moon
   *4. full moon
   5. new moon

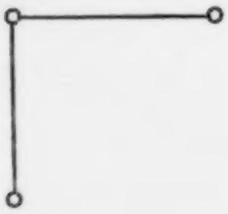
10. The moon makes a complete revolution around the earth about once every
   1. hour
   2. day
   3. week
   *4. month
   5. year

11. During the third quarter the moon sets at
   *1. noon
   2. midnight
   3. sunrise
   4. sunset

12. During the moon's trip around the earth, it is waxing
   1. one fourth of the time
   2. one third of the time
   *3. one half of the time
   4. two thirds of the time
   5. three fourths of the time

13. Which of the following angles represents the positions of the sun, earth, and moon during the crescent moon phase?

1.


2.


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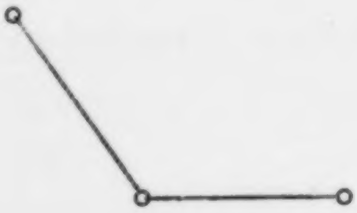
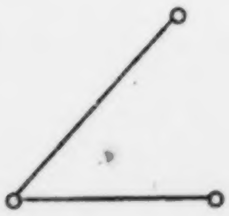
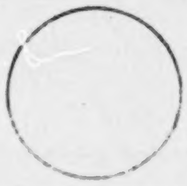


*4.


14. During which phase does the moon set at sunset?
   *1. crescent moon
   2. halfmoon
   3. gibbous moon
   4. full moon

15. Which diagram shows the gibbous moon as "seen from earth"?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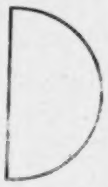
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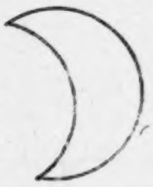
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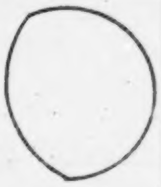

*4

5

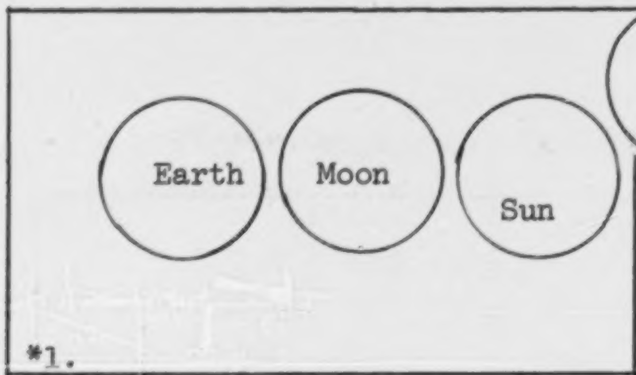
16. When the moon begins and ends its cycle, from the earth we see
   *1. a thin crescent
   2. one fourth of the surface
   3. one half of the surface
   4. all of the surface
   5. none of the surface

17. When the moon is directly between the earth and the sun, the phase is:
   1. full moon
   *2. new moon
   3. first quarter
   4. third quarter
   5. none of the above

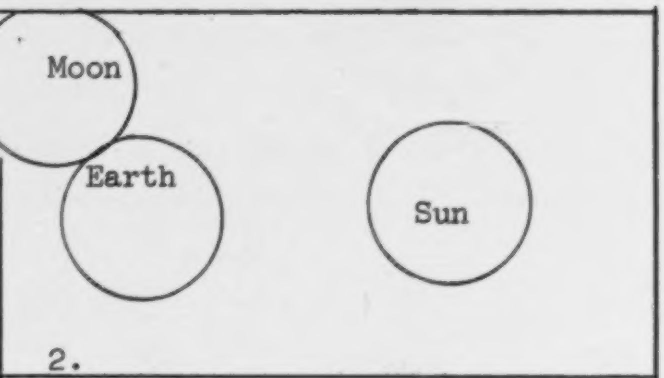
18. During the 28 day trip of the moon around the earth there are
   1. 2 phases
   2. 4 phases
   3. 6 phases
   *4. 8 phases
   5. 10 phases

19. Variations in the amount of sunlight reflected toward the earth from the moon cause:
   1. waxing
   2. waning
   3. apogees
   *4. phases
   5. perigees

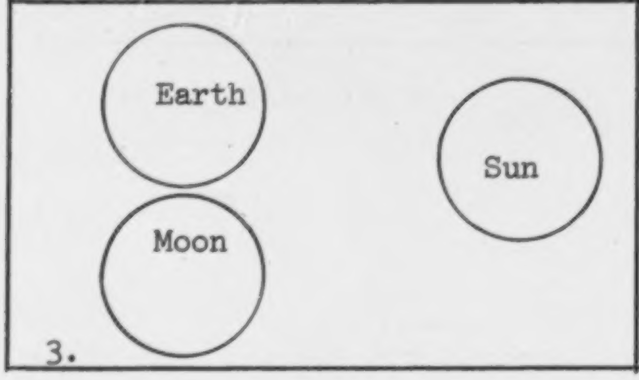
20. Select the diagram that best represents the position of sun, moon and earth during the new moon phase.


Earth
Moon
Sun

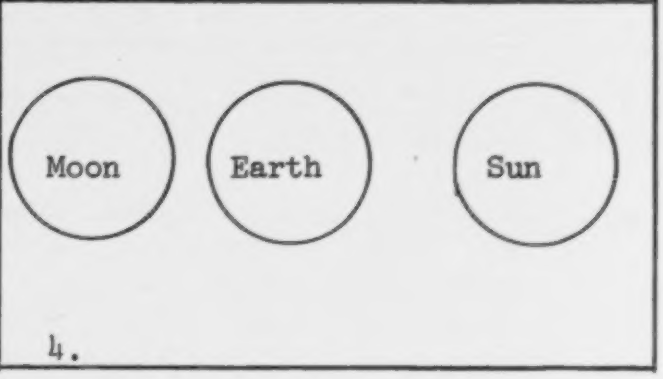
*1.


Moon
Earth
Sun

2.


Earth
Sun
Moon

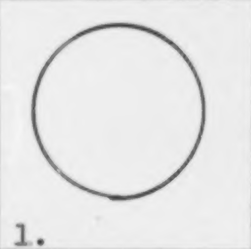
3.


Moon
Earth
Sun

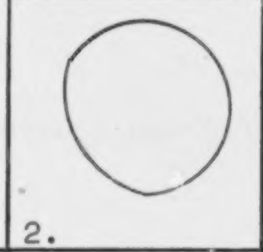
4.

21. The moon which is seen late at night and in the early morning hours is the:
  1. gibbous moon
  2. crescent moon
  3. half moon
  4. waxing moon
  *5. waning moon

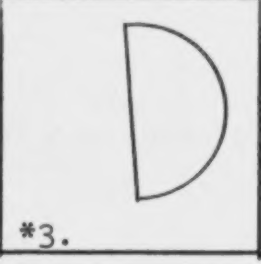
22. Which diagram shows the moon at first quarter



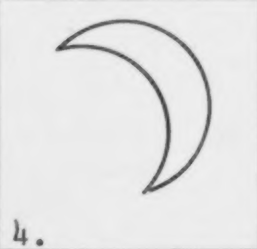
1.



2.



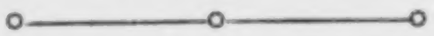
*3.

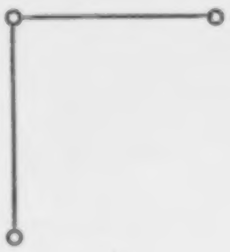


4.

5.

23. Which of the following angles represents the position of the sun, earth, and moon during the full moon phase?

*1.


2.


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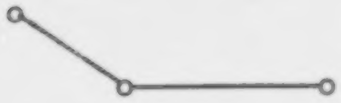

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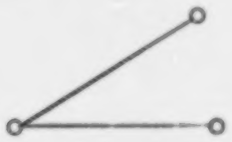
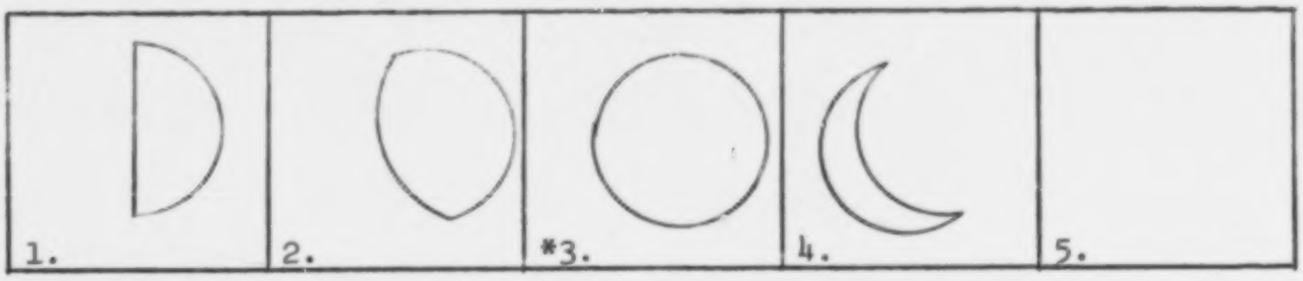


24. Which diagram illustrates the full moon "as seen from earth"?



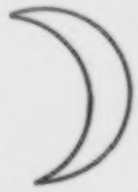
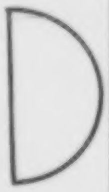
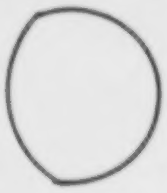
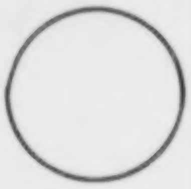
25. During the last two weeks of its orbit the moon is:
 1. perigee
 2. apogee
 3. phasing
*4. waning
 5. waxing

26. The new moon as seen from earth is:
 1. half lighted
 2. three fourths lighted
 3. completely lighted
 4. only slightly lighted
*5. none of the above

27. If the moon was crescent on October 3, what phase occurred on October 1?
 1. full moon or new moon
*2. new moon or half moon
 3. gibbous moon or full moon
 4. half moon or full moon
 5. none of the above

28. During the full moon phase the moon sets at what time?
*1. sunrise
 2. sunset
 3. midnight
 4. noon

29. Choose the diagram that shows a crescent moon

| | | | | |
|---|---|---|---|---|
| <br>*1. | <br>2. | <br>3. | <br>4. | 5. |

30. In about one week the phase of the moon would change from new moon to:
   1. crescent moon
   *2. half moon
   3. gibbous moon
   4. full moon
   5. none of the above

# APPENDIX F

## Raw Data for Experiment I

TABLE 22. RAW DATA FOR EXPERIMENTAL TREATMENT 1, EXPERIMENT I

| Subject number | Chronological age (in months) | Performance scores | |
|---|---|---|---|
| | | Pretest | Posttest |
| 1 101 | 130 | 3 | 9 |
| 1 102 | 123 | 5 | 13 |
| 1 103 | 130 | 5 | 11 |
| 1 104 | 134 | 5 | 13 |
| 1 105 | 133 | 4 | 14 |
| 1 106 | 144 | 2 | 10 |
| 1 107 | 151 | 4 | 8 |
| 1 108 | 159 | 5 | 7 |
| 1 109 | 131 | 7 | 13 |
| 1 110 | 132 | 2 | 8 |
| 1 111 | 130 | 3 | 7 |
| 1 112 | 152 | 2 | 8 |
| 1 113 | 129 | 6 | 17 |
| 1 114 | 133 | 8 | 7 |
| 1 115 | 124 | 6 | 8 |
| 1 116 | 129 | 8 | 10 |

TABLE 23. RAW DATA FOR EXPERIMENTAL TREATMENT 2, EXPERIMENT I

| Subject number | Chronological age (in months) | Performance scores | |
|---|---|---|---|
| | | Pretest | Posttest |
| 2 101 | 130 | 4 | 5 |
| 2 102 | 131 | 1 | 6 |
| 2 103 | 131 | 4 | 8 |
| 2 104 | 129 | 3 | 7 |
| 2 105 | 144 | 4 | 10 |
| 2 106 | 125 | 5 | 12 |
| 2 107 | 140 | 8 | 7 |
| 2 108 | 126 | 6 | 13 |
| 2 109 | 138 | 4 | 8 |
| 2 110 | 133 | 3 | 10 |
| 2 111 | 138 | 4 | 7 |
| 2 112 | 128 | 3 | 9 |
| 2 113 | 132 | 5 | 5 |
| 2 114 | 125 | 2 | 7 |
| 2 115 | 126 | 5 | 4 |
| 2 116 | 124 | 6 | 8 |

TABLE 24. RAW DATA FOR EXPERIMENTAL TREATMENT 3, EXPERIMENT I

| Subject number | Chronological age (in months) | Performance scores<br>Pretest | Performance scores<br>Posttest |
|---|---|---|---|
| 1 201 | 128 | 5 | 8 |
| 1 202 | 135 | 3 | 8 |
| 1 203 | 124 | 5 | 8 |
| 1 204 | 128 | 8 | 9 |
| 1 205 | 123 | 2 | 5 |
| 1 206 | 140 | 6 | 6 |
| 1 207 | 142 | 4 | 14 |
| 1 208 | 153 | 6 | 8 |
| 1 209 | 125 | 5 | 12 |
| 1 210 | 123 | 3 | 5 |
| 1 211 | 128 | 5 | 6 |
| 1 212 | 124 | 7 | 13 |
| 1 213 | 135 | 4 | 5 |
| 1 214 | 128 | 4 | 15 |
| 1 215 | 124 | 9 | 8 |
| 1 216 | 136 | 2 | 9 |

TABLE 25. RAW DATA FOR EXPERIMENTAL TREATMENT 4, EXPERIMENT I

| Subject number | Chronological age (in months) | Performance scores<br>Pretest | Performance scores<br>Posttest |
|---|---|---|---|
| 2 201 | 136 | 3 | 10 |
| 2 202 | 142 | 2 | 5 |
| 2 203 | 131 | 6 | 8 |
| 2 204 | 126 | 2 | 13 |
| 2 205 | 125 | 4 | 6 |
| 2 206 | 125 | 5 | 7 |
| 2 207 | 140 | 6 | 10 |
| 2 208 | 145 | 3 | 11 |
| 2 209 | 135 | 5 | 8 |
| 2 210 | 134 | 2 | 12 |
| 2 211 | 125 | 4 | 7 |
| 2 212 | 126 | 6 | 17 |
| 2 213 | 128 | 5 | 12 |
| 2 214 | 129 | 5 | 9 |
| 2 215 | 130 | 3 | 6 |
| 2 216 | 128 | 6 | 12 |

TABLE 26. RAW DATA FOR EXPERIMENTAL TREATMENT 5, EXPERIMENT I

| Subject number | Chronological age (in months) | Performance scores | |
|---|---|---|---|
| | | Pretest | Posttest |
| 1 201 | 133 | 2 | 9 |
| 1 202 | 132 | 2 | 9 |
| 1 203 | 132 | 7 | 8 |
| 1 204 | 127 | 5 | 7 |
| 1 205 | 134 | 4 | 9 |
| 1 206 | 134 | 2 | 4 |
| 1 207 | 144 | 3 | 6 |
| 1 208 | 133 | 3 | 8 |
| 1 209 | 125 | 4 | 6 |
| 1 210 | 124 | 5 | 8 |
| 1 211 | 132 | 6 | 6 |
| 1 212 | 128 | 6 | 7 |
| 1 213 | 133 | 3 | 11 |
| 1 214 | 131 | 4 | 8 |
| 1 215 | 144 | 5 | 10 |
| 1 216 | 134 | 6 | 11 |

TABLE 27. RAW DATA FOR EXPERIMENTAL TREATMENT 6, EXPERIMENT I

| Subject number | Chronological age (in months) | Performance scores | |
|---|---|---|---|
| | | Pretest | Posttest |
| 2 201 | 126 | 7 | 12 |
| 2 202 | 125 | 5 | 6 |
| 2 203 | 133 | 2 | 11 |
| 2 204 | 134 | 4 | 8 |
| 2 205 | 124 | 3 | 8 |
| 2 206 | 127 | 6 | 12 |
| 2 207 | 138 | 4 | 7 |
| 2 208 | 134 | 4 | 10 |
| 2 209 | 139 | 4 | 7 |
| 2 210 | 228 | 3 | 10 |
| 2 211 | 131 | 4 | 8 |
| 2 212 | 133 | 6 | 7 |
| 2 213 | 123 | 4 | 11 |
| 2 214 | 126 | 6 | 9 |
| 2 215 | 135 | 4 | 5 |
| 2 216 | 124 | 6 | 7 |

# APPENDIX G

## Raw Data for Experiment II

TABLE 28. RAW DATA FOR EXPERIMENTAL TREATMENT 1, EXPERIMENT II

| | | Performance scores | |
|---|---|---|---|
| Subject number | Chronological age (in months) | Pretest | Posttest |
| 1 101 | 148 | 5 | 11 |
| 1 102 | 151 | 5 | 11 |
| 1 103 | 155 | 5 | 9 |
| 1 104 | 152 | 4 | 9 |
| 1 105 | 155 | 3 | 10 |
| 1 106 | 151 | 5 | 12 |
| 1 107 | 148 | 5 | 15 |
| 1 108 | 155 | 8 | 14 |
| 1 109 | 155 | 8 | 16 |
| 1 110 | 151 | 5 | 12 |
| 1 111 | 148 | 6 | 8 |
| 1 112 | 157 | 8 | 15 |
| 1 113 | 159 | 6 | 12 |
| 1 114 | 157 | 6 | 17 |
| 1 115 | 157 | 7 | 13 |
| 1 116 | 152 | 7 | 20 |
| 1 117 | 156 | 5 | 15 |
| 1 118 | 157 | 6 | 18 |

## TABLE 29. RAW DATA FOR EXPERIMENTAL TREATMENT 2, EXPERIMENT II

| Subject number | Chronological age (in months) | Performance scores |  |
|---|---|---|---|
|  |  | Pretest | Posttest |
| 2 101 | 157 | 1 | 13 |
| 2 102 | 158 | 3 | 15 |
| 2 103 | 152 | 7 | 16 |
| 2 104 | 154 | 4 | 12 |
| 2 105 | 149 | 5 | 8 |
| 2 106 | 154 | 6 | 17 |
| 2 107 | 158 | 7 | 8 |
| 2 108 | 155 | 5 | 9 |
| 2 109 | 151 | 5 | 16 |
| 2 110 | 155 | 6 | 18 |
| 2 111 | 158 | 8 | 15 |
| 2 112 | 156 | 8 | 26 |
| 2 113 | 154 | 7 | 14 |
| 2 114 | 155 | 9 | 25 |
| 2 115 | 151 | 6 | 19 |
| 2 116 | 158 | 4 | 9 |
| 2 117 | 151 | 5 | 10 |
| 2 118 | 152 | 6 | 21 |

TABLE 30. RAW DATA FOR EXPERIMENTAL TREATMENT 3, EXPERIMENT II

| Subject number | Chronological age (in months) | Performance scores | |
|---|---|---|---|
| | | Pretest | Posttest |
| 1 201 | 158 | 6 | 20 |
| 1 202 | 154 | 3 | 11 |
| 1 203 | 156 | 5 | 19 |
| 1 204 | 153 | 6 | 9 |
| 1 205 | 155 | 6 | 15 |
| 1 206 | 153 | 8 | 9 |
| 1 207 | 148 | 6 | 21 |
| 1 208 | 158 | 4 | 12 |
| 1 209 | 172 | 4 | 12 |
| 1 210 | 157 | 4 | 9 |
| 1 211 | 148 | 2 | 13 |
| 1 212 | 150 | 9 | 15 |
| 1 213 | 149 | 3 | 14 |
| 1 214 | 154 | 7 | 15 |
| 1 215 | 151 | 5 | 11 |
| 1 216 | 157 | 6 | 23 |
| 1 217 | 156 | 5 | 22 |
| 1 218 | 151 | 6 | 15 |

TABLE 31. RAW DATA FOR EXPERIMENTAL TREATMENT 4, EXPERIMENT II

| Subject number | Chronological age (in months) | Performance scores | |
|---|---|---|---|
| | | Pretest | Posttest |
| 2 201 | 154 | 4 | 11 |
| 2 202 | 150 | 5 | 7 |
| 2 203 | 148 | 6 | 16 |
| 2 204 | 157 | 3 | 13 |
| 2 205 | 155 | 4 | 21 |
| 2 206 | 137 | 3 | 8 |
| 2 207 | 172 | 4 | 8 |
| 2 208 | 136 | 4 | 9 |
| 2 209 | 158 | 5 | 10 |
| 2 210 | 153 | 2 | 13 |
| 2 211 | 156 | 7 | 19 |
| 2 212 | 162 | 6 | 13 |
| 2 213 | 152 | 5 | 12 |
| 2 214 | 161 | 6 | 11 |
| 2 215 | 154 | 4 | 13 |
| 2 216 | 148 | 6 | 11 |
| 2 217 | 158 | 6 | 20 |
| 2 218 | 166 | 7 | 13 |

TABLE 32. RAW DATA FOR EXPERIMENTAL TREATMENT 5, EXPERIMENT II

| Subject number | Chronological age (in months) | Performance scores | |
|---|---|---|---|
| | | Pretest | Posttest |
| 1 201 | 158 | 6 | 11 |
| 1 202 | 157 | 8 | 9 |
| 1 203 | 161 | 4 | 11 |
| 1 204 | 159 | 2 | 9 |
| 1 205 | 185 | 4 | 11 |
| 1 206 | 141 | 3 | 15 |
| 1 207 | 153 | 4 | 14 |
| 1 208 | 148 | 2 | 7 |
| 1 209 | 159 | 5 | 8 |
| 1 210 | 151 | 6 | 12 |
| 1 211 | 156 | 5 | 10 |
| 1 212 | 147 | 5 | 11 |
| 1 213 | 151 | 6 | 14 |
| 1 214 | 158 | 8 | 11 |
| 1 215 | 154 | 8 | 11 |
| 1 216 | 163 | 4 | 9 |
| 1 217 | 182 | 2 | 10 |
| 1 218 | 155 | 6 | 10 |

TABLE 33. RAW DATA FOR EXPERIMENTAL TREATMENT 6, EXPERIMENT II

| Subject number | Chronological age (in months) | Performance scores<br>Pretest | Performance scores<br>Posttest |
|---|---|---|---|
| 2 201 | 153 | 7 | 12 |
| 2 202 | 147 | 5 | 5 |
| 2 203 | 156 | 5 | 15 |
| 2 204 | 155 | 6 | 11 |
| 2 205 | 156 | 3 | 5 |
| 2 206 | 149 | 7 | 9 |
| 2 207 | 156 | 3 | 5 |
| 2 208 | 153 | 5 | 8 |
| 2 209 | 156 | 5 | 13 |
| 2 210 | 155 | 7 | 8 |
| 2 211 | 147 | 5 | 13 |
| 2 212 | 151 | 2 | 8 |
| 2 213 | 149 | 4 | 9 |
| 2 214 | 152 | 3 | 8 |
| 2 215 | 150 | 5 | 7 |
| 2 216 | 158 | 3 | 11 |
| 2 217 | 153 | 6 | 6 |
| 2 218 | 148 | 5 | 10 |

# APPENDIX H

## Raw Data for Experiment III

TABLE 34. RAW DATA FOR EXPERIMENTAL TREATMENT 1, EXPERIMENT III

| | | Performance scores | |
|---|---|---|---|
| Subject number | Chronological age (in months) | Pretest | Posttest |
| 1 101 | 215 | 5 | 9 |
| 1 102 | 216 | 3 | 11 |
| 1 103 | 200 | 5 | 20 |
| 1 104 | 201 | 6 | 18 |
| 1 105 | 204 | 5 | 8 |
| 1 106 | 214 | 7 | 21 |
| 1 107 | 200 | 7 | 12 |
| 1 108 | 208 | 5 | 8 |
| 1 109 | 201 | 2 | 11 |
| 1 110 | 205 | 6 | 12 |
| 1 111 | 212 | 6 | 22 |
| 1 112 | 202 | 5 | 10 |
| 1 113 | 202 | 5 | 10 |
| 1 114 | 215 | 4 | 10 |
| 1 115 | 219 | 5 | 25 |
| 1 116 | 196 | 6 | 12 |
| 1 117 | 215 | 8 | 20 |

TABLE 35. RAW DATA FOR EXPERIMENTAL TREATMENT 2, EXPERIMENT III

| Subject number | Chronological age (in months) | Performance scores | |
|---|---|---|---|
| | | Pretest | Posttest |
| 2 101 | 202 | 4 | 13 |
| 2 102 | 199 | 4 | 16 |
| 2 103 | 203 | 6 | 11 |
| 2 104 | 200 | 7 | 20 |
| 2 105 | 196 | 6 | 15 |
| 2 106 | 209 | 2 | 10 |
| 2 107 | 238 | 6 | 8 |
| 2 108 | 211 | 7 | 25 |
| 2 109 | 196 | 7 | 19 |
| 2 110 | 206 | 6 | 12 |
| 2 111 | 217 | 8 | 23 |
| 2 112 | 208 | 5 | 21 |
| 2 113 | 201 | 6 | 9 |
| 2 114 | 206 | 8 | 22 |
| 2 115 | 210 | 5 | 17 |
| 2 116 | 199 | 4 | 19 |
| 2 117 | 218 | 4 | 10 |

TABLE 36. RAW DATA FOR EXPERIMENTAL TREATMENT 3, EXPERIMENTAL III

| Subject number | Chronological age (in months) | Performance scores | |
|---|---|---|---|
| | | Pretest | Posttest |
| 1 201 | 201 | 3 | 12 |
| 1 202 | 236 | 1 | 9 |
| 1 203 | 208 | 6 | 12 |
| 1 204 | 196 | 5 | 17 |
| 1 205 | 202 | 4 | 11 |
| 1 206 | 204 | 4 | 12 |
| 1 207 | 199 | 4 | 20 |
| 1 208 | 228 | 3 | 22 |
| 1 209 | 216 | 2 | 10 |
| 1 210 | 198 | 6 | 12 |
| 1 211 | 237 | 4 | 8 |
| 1 212 | 212 | 4 | 17 |
| 1 213 | 200 | 5 | 11 |
| 1 214 | 210 | 8 | 24 |
| 1 215 | 195 | 5 | 17 |
| 1 216 | 202 | 4 | 14 |
| 1 217 | 217 | 6 | 21 |

TABLE 37. RAW DATA FOR EXPERIMENTAL TREATMENT 4, EXPERIMENT III

| Subject number | Chronological age (in months) | Performance scores | |
|---|---|---|---|
| | | Pretest | Posttest |
| 2 201 | 205 | 8 | 20 |
| 2 202 | 208 | 5 | 14 |
| 2 203 | 208 | 6 | 12 |
| 2 204 | 196 | 8 | 24 |
| 2 205 | 209 | 5 | 7 |
| 2 206 | 205 | 7 | 17 |
| 2 207 | 203 | 6 | 18 |
| 2 208 | 212 | 8 | 22 |
| 2 209 | 208 | 7 | 13 |
| 2 210 | 202 | 5 | 15 |
| 2 211 | 203 | 5 | 9 |
| 2 212 | 212 | 5 | 12 |
| 2 213 | 199 | 5 | 8 |
| 2 214 | 210 | 5 | 22 |
| 2 215 | 245 | 3 | 11 |
| 2 216 | 201 | 6 | 21 |
| 2 217 | 213 | 5 | 19 |

TABLE 38. RAW DATA FOR EXPERIMENTAL TREATMENT 5, EXPERIMENT III

| Subject number | Chronological age (in months) | Performance scores | |
|---|---|---|---|
| | | Pretest | Posttest |
| 1 201 | 205 | 5 | 8 |
| 1 202 | 212 | 6 | 10 |
| 1 203 | 209 | 3 | 9 |
| 1 204 | 198 | 3 | 15 |
| 1 205 | 208 | 5 | 23 |
| 1 206 | 208 | 4 | 9 |
| 1 207 | 221 | 6 | 8 |
| 1 208 | 212 | 8 | 16 |
| 1 209 | 213 | 6 | 14 |
| 1 210 | 200 | 6 | 17 |
| 1 211 | 205 | 5 | 16 |
| 1 212 | 217 | 6 | 15 |
| 1 213 | 210 | 4 | 9 |
| 1 214 | 235 | 5 | 10 |
| 1 215 | 209 | 9 | 5 |
| 1 216 | 224 | 7 | 10 |
| 1 217 | 205 | 3 | 11 |

TABLE 39. RAW DATA FOR EXPERIMENTAL TREATMENT 6, EXPERIMENT III

| Subject number | Chronological age (in months) | Performance scores<br>Pretest | Posttest |
|---|---|---|---|
| 2 201 | 207 | 7 | 15 |
| 2 202 | 217 | 5 | 10 |
| 2 203 | 203 | 7 | 12 |
| 2 204 | 211 | 6 | 7 |
| 2 205 | 206 | 6 | 10 |
| 2 206 | 209 | 7 | 13 |
| 2 207 | 219 | 5 | 10 |
| 2 208 | 212 | 4 | 9 |
| 2 209 | 199 | 5 | 8 |
| 2 210 | 208 | 4 | 10 |
| 2 211 | 222 | 5 | 9 |
| 2 212 | 211 | 7 | 13 |
| 2 213 | 214 | 6 | 11 |
| 2 214 | 204 | 5 | 7 |
| 2 215 | 207 | 3 | 11 |
| 2 216 | 215 | 7 | 5 |
| 2 217 | 200 | 6 | 14 |